NBS CIRCULAR 589

Tables of Dielectric Dispersion Data for Pure Liquids and Dilute Solutions

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Floyd Buckley and Arthur A. Maryott

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Tables of Dielectric Dispersion Data for Pure Liquids and Dilute Solutions

Floyd Buckley and Arthur A. Maryott

Primary dielectric dispersion data and characteristic dispersion parameters are tabulated for almost 200 substances in the liquid state and for dilute aqueous and nonaqueous solutions with more than 150 solutes. There are 6 tables and 1 section of graphs. There are 4 tables for pure liquids, 2 containing summaries of the derived dispersion parameters and 2 containing the primary data. The section on graphs supplements the tables for pure liquids and contains reproductions of pertinent data that are available only in the form of graphs.

1. Introduction

This tabulation of the data on dielectric dispersion for pure liquids and dilute solutions is part of a general program at the National Bureau of Standards for the critical evaluation and compilation of data from selected fields of physics and chemistry. The first table of the series on dielectric properties, titled Table of Dielectric Constants of Pure Liquids, appeared as NBS Circular 514, and the second table, titled Table of Dielectric Constants and Electric Dipole Moments of Substances in the Gaseous State, appeared as NBS Circular 537. The preparation of additional tables of dielectric properties is in progress.

This tabulation contains primary dispersion data and derived dispersion parameters for pure liquids and dilute solutions. Tables 1 to 4 pertain to pure liquids and consist of three parts: (1) Characteristic dispersion parameters (Cole-Cole [1] representation) are given in tables 1 and 2 for inorganic and organic substances, respectively; (2) original data from the literature are listed in the corresponding tables 3 and 4; and (3) pertinent data available in the literature in graphical form only are reproduced in a separate section. Only those graphs are reproduced that add significantly to the general picture of dispersion represented by tables 1 to 4. Tables 5 and 6 contain the numerical data and the derived dispersion parameters for dilute aqueous and nonaqueous solutions.

2. Representation of Dispersion Data for Pure Liquids [2]

At ordinary temperatures the dependence of the dielectric constant, ϵ', and the dielectric loss factor, ϵ'', on frequency is, for a large class of compounds, adequately represented by the dispersion equations of Debye. For the compounds listed in tables 1 to 4, deviations from this behavior fall into one of the following types:

1. The plot of the complex dielectric constant $\epsilon=\epsilon'-i\cdot\epsilon''$ in the complex plane is a segment of a semicircle. The loss curve $\epsilon''=f(\ln \lambda)$ has the characteristic Debye symmetry, but the maximum loss is reduced and the half-width of the absorption curve is increased.

2. The plot of ϵ in the complex plane is asymmetrical over the entire range of dispersion.

3. The absorption near the high-frequency limit of the dispersion range is considerably larger, and the limiting value $\epsilon'_{\lambda=0}$ is significantly smaller, than that predicted from the Debye equations.

Although it is to be expected that more extensive and accurate data will reveal a rather complex dependence of ϵ' and ϵ'' on frequency and molecular structure, data at present available for compounds exhibiting the behavior of types 1 and 2 are adequately represented by the two empirical modifications of the Debye functions introduced by Cole (see footnote 1). For substances showing the behavior of type 3 the data can best be represented by superimposing two or more independent but overlapping dispersion curves.

2.1. Cole-Cole Representation

The general dispersion equation for the complex dielectric constant is

$$\epsilon=\epsilon'-i\cdot\epsilon''=\epsilon_0+\frac{\epsilon_\infty-\epsilon_0}{1+(i\cdot\omega\tau)^{1-\alpha}},$$

where

$\epsilon_0=\epsilon$ for $\lambda=0$

$\epsilon_\infty=\epsilon$ for $\lambda=\infty$

λ=wavelength in vacuum (or air)

$\omega=2\pi\frac{c}{\lambda}$ (c=velocity of light in vacuum)

τ=characteristic relaxation time

$\lambda_c=2\pi c\tau$=critical wavelength

α=distribution (relaxation time) parameter.

[1] K. S. Cole and R. H. Cole, J. Chem. Phys. **9**, 341 (1941); D. W. Davidson and R. H. Cole, J. Chem. Phys. **19**, 1484 (1951).

[2] General discussions of dielectric phenomena are found in the following books and monographs:

P. Debye, Polar molecules, Chemical Catalog Co., New York, 1929 (new unrevised edition, Dover Publications, New York, N. Y., 1945).

C. P. Smyth, Dielectric behaviour and structure (McGraw-Hill Book Co., New York, N. Y., 1955).

C. J. F. Böttcher, Theory of electric polarization (Elsevier Publishing Co., New York, N. Y., 1952).

H. Fröhlich, Theory of dielectrics (Oxford Univ. Press, London, 1949).

W. F. Brown, Jr., Dielectrics, Handbuch der Physik, vol. 17 (Springer-Verlag, Berlin, 1956).

The locus of ϵ in the complex plane is a segment of a semicircle with the parametric representation:

$$\epsilon'-\epsilon_0=\frac{\epsilon_\infty-\epsilon_0}{2}\cdot\left\{1-\frac{\sinh\,[(1-\alpha)\ln\,\omega\tau]}{\cosh\,[(1-\alpha)\ln\,\omega\tau]+\sin\,\alpha\,\frac{\pi}{2}}\right\}$$

$$\epsilon''=\frac{\epsilon_\infty-\epsilon_0}{2}\cdot\left\{\frac{\cos\,\alpha\,\frac{\pi}{2}}{\cosh\,[(1-\alpha)\ln\,\omega\tau]+\sin\,\alpha\,\frac{\pi}{2}}\right\}$$

The locus can be easily drawn from the following:

(a) Coordinates of the center,

$$\epsilon'=\frac{\epsilon_\infty+\epsilon_0}{2}$$

$$\epsilon''=-\frac{\epsilon_\infty-\epsilon_0}{2}\cdot\tan\,\alpha\,\frac{\pi}{2}.$$

(b) Radius of the circle,

$$R=\frac{\epsilon_\infty-\epsilon_0}{2}\cdot\sec\,\alpha\,\frac{\pi}{2}.$$

Useful characteristics of the dispersion curve are:

(a) Maximum loss factor,

$$\epsilon''_{\max}=\frac{\epsilon_\infty-\epsilon_0}{2}\cdot\tan\,(1-\alpha)\,\frac{\pi}{4}.$$

(b) Critical wavelength for which ϵ'' is a maximum,

$$\frac{\lambda_c}{\lambda}=\left(\frac{v}{u}\right)^{\frac{1}{1-\alpha}}.$$

The geometrical significance of these dispersion parameters is shown in figure 1.

The graphs given in figures 2, 3, and 4, in conjunction with the parameters given in tables 1 and 2, permit a rapid estimation of ϵ' and ϵ'' for any wavelength.

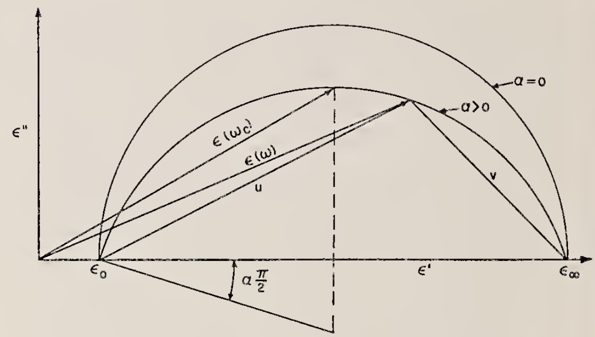

FIGURE 1. *Representation in the complex plane of* $\epsilon=\epsilon_0+(\epsilon_\infty-\epsilon_0)/[1+(i\cdot\omega\tau)^{1-\alpha}]$.

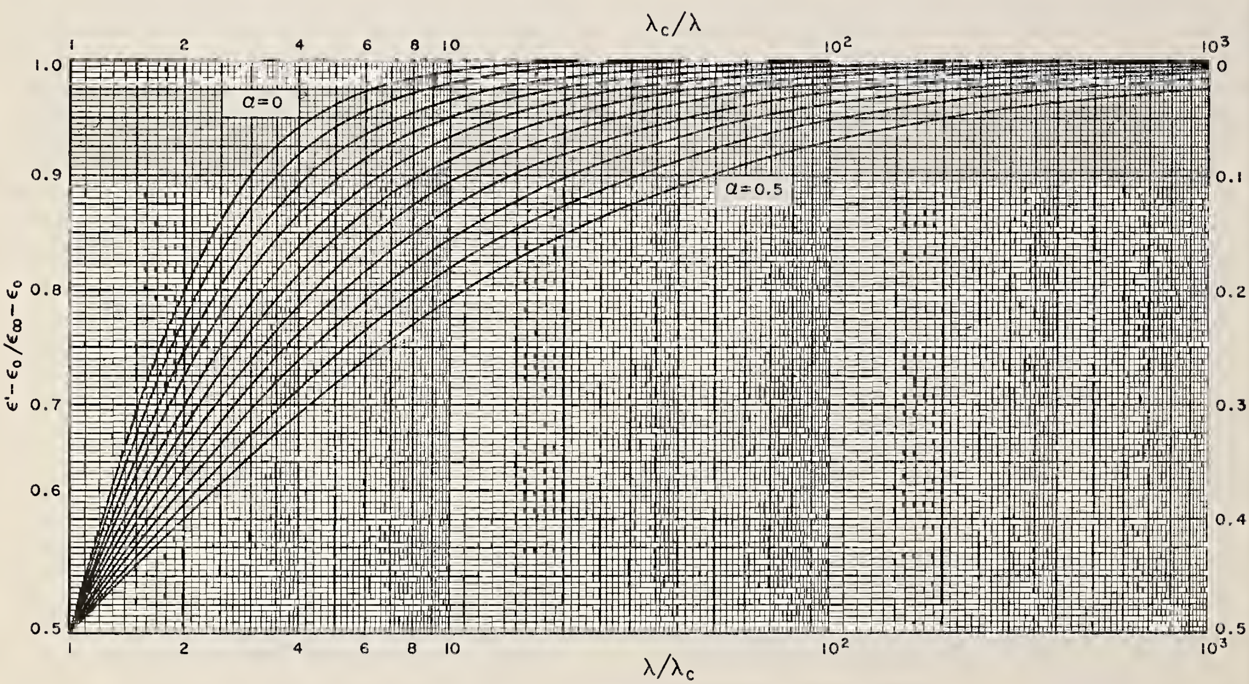

FIGURE 2. *A family of dispersion curves.*

The value of the Cole-Cole distribution parameter, α, is given for intervals of 0.05. The scale of ordinates on the right is to be used in conjunction with the upper scale of abscissas.

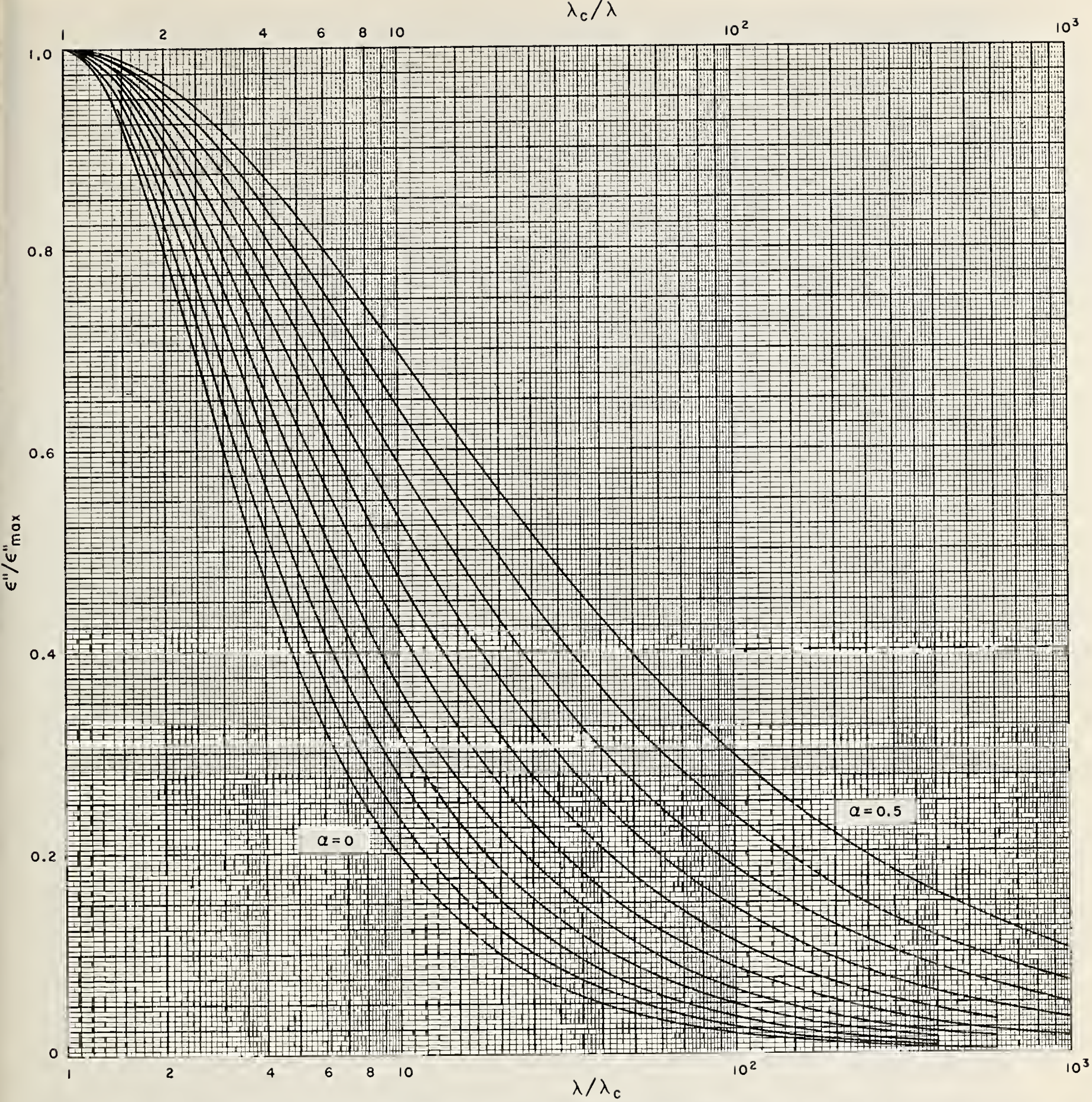

FIGURE 3. *A family of absorption curves.*

The value of the Cole-Cole distribution parameter, α, is given for intervals of 0.05. The scale of ordinates on the right is to be used in conjunction with the upper scale of abscissas.

2.2. Cole-Davidson Representation

The parameters characterizing the Cole-Davidson representation (see footnote 1) are defined by

$$\epsilon = \epsilon' - i \cdot \epsilon'' = \epsilon_0 + \frac{\epsilon_\infty - \epsilon_0}{(1 + i \cdot \omega\tau)^\beta}.$$

The parametric equations for the locus of ϵ in the complex plane are:

$$\epsilon' - \epsilon_0 = (\epsilon_\infty - \epsilon_0) \cdot (\cos\varphi)^\beta \cdot \cos\beta\varphi$$

$$\epsilon'' = (\epsilon_\infty - \epsilon_0) \cdot (\cos\varphi)^\beta \cdot \sin\beta\varphi$$

$$\tan\varphi \equiv \omega\tau,$$

and in polar form,

$$R = (\epsilon_\infty - \epsilon_0) \cdot \left(\cos\frac{\theta}{\beta}\right)^\beta$$

$$\theta = \tan^{-1}\frac{\epsilon''}{\epsilon' - \epsilon_\infty} = \beta\varphi.$$

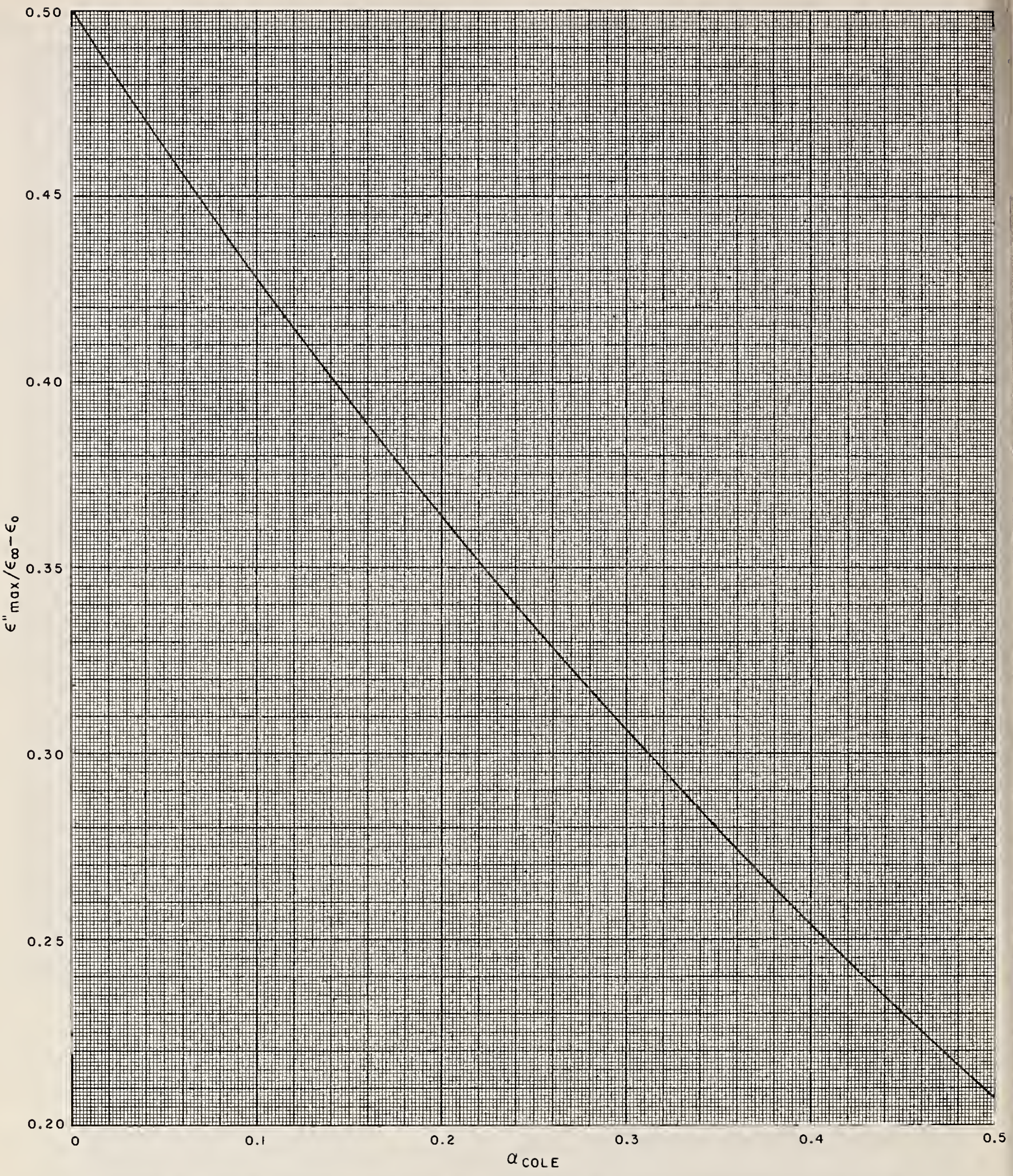

FIGURE 4. *Relative maximum absorption as a function of the Cole-Cole distribution parameter, α.*

In this representation, if $\beta<1$, the locus degenerates into a segment of a Debye semicircle for $\omega\rightarrow 0$, and into a segment of a straight line $\theta=\beta(\pi/2)$ for $\omega\rightarrow\infty$. A family of loci,

$$R'=\frac{\epsilon-\epsilon_0}{\epsilon_\infty-\epsilon_0}=\left(\cos\frac{\theta}{\beta}\right)^{\beta},$$

is shown in figure 5.

The significance of the parameter ω_c (or λ_c, τ) differs from that of the corresponding quantity in the Cole-Cole representation. In the latter case the condition that determines ω_c is that ϵ'' shall be a maximum, whereas in this representation the condition is $\theta=(\pi/4)$. The relation $\omega_c\tau=1$ is sat-

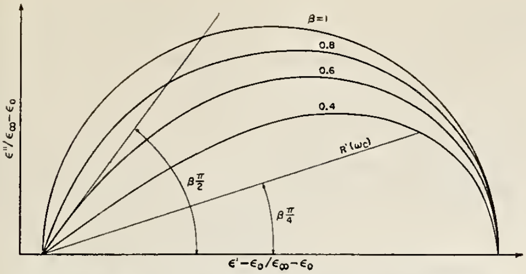

FIGURE 5. *A family of curves representing* $(\epsilon-\epsilon_0)/(\epsilon_\infty-\epsilon_0)=1/(1+i\cdot\omega\tau)^\beta$.

isfied in both cases. The parameter λ_c for both representations appears in tables 1 and 2.

2.3. Debye Representation

The Debye representation is the special case, $\alpha=0$, of the Cole-Cole representation, or $\beta=1$ of the Cole-Davidson representation.

2.4. Two or More Relaxation Times

Tentative assignments of the dispersion characteristics of a second dispersion region are given for a few compounds. These parameters satisfy the following relations, in which subscripts 1 and 2 denote the dispersion regions at low and high frequency, respectively. In the complex plane,

$$\epsilon=\epsilon'-i\cdot\epsilon''=\epsilon_2+\delta\epsilon$$

$$\delta\epsilon=\epsilon_1-\epsilon_{10}=(\epsilon_1'-\epsilon_{10})-i\cdot\epsilon_1''=\frac{\epsilon_{1\infty}-\epsilon_{10}}{1+i\cdot\omega\tau_1}$$

$$\epsilon_2=\epsilon_2'-i\cdot\epsilon_2''=\epsilon_{20}+\frac{\epsilon_{2\infty}-\epsilon_{20}}{1+i\cdot\omega\tau_2}$$

so that

$$\delta\epsilon'=\epsilon_{1\infty}'-\epsilon_{10}=\frac{\epsilon_{1\infty}-\epsilon_{10}}{1+(\omega\tau_1)^2}$$

$$\delta\epsilon''=\epsilon_1''=\frac{\epsilon_{1\infty}-\epsilon_{10}}{1+(\omega\tau_1)^2}\cdot\omega\tau_1$$

$$\epsilon_2'=\epsilon'-\frac{\epsilon_{1\infty}-\epsilon_{10}}{1+(\omega\tau_1)^2}=\epsilon_{20}+\frac{\epsilon_{2\infty}-\epsilon_{20}}{1+(\omega\tau_2)^2}$$

$$\epsilon_2''=\epsilon''-\frac{\epsilon_{1\infty}-\epsilon_{10}}{1+(\tau_1)^2\omega}\cdot\omega\tau_1=\frac{\epsilon_{2\infty}-\epsilon_{20}}{1+(\omega\tau_2)^2}\cdot\omega\tau_2.$$

The geometrical significance of these relations is shown in figure 6 for the special case in which the dispersion in both regions is of the Debye type.

The method of representation can be extended to allow for more than two regions of dispersion and generalized to allow for $\alpha_i\neq 0$. The dispersion parameters for successive regions of dispersion are distinguished in tables 1 and 2 by numbers in parentheses in the column for $\epsilon_{\lambda=\infty}$.

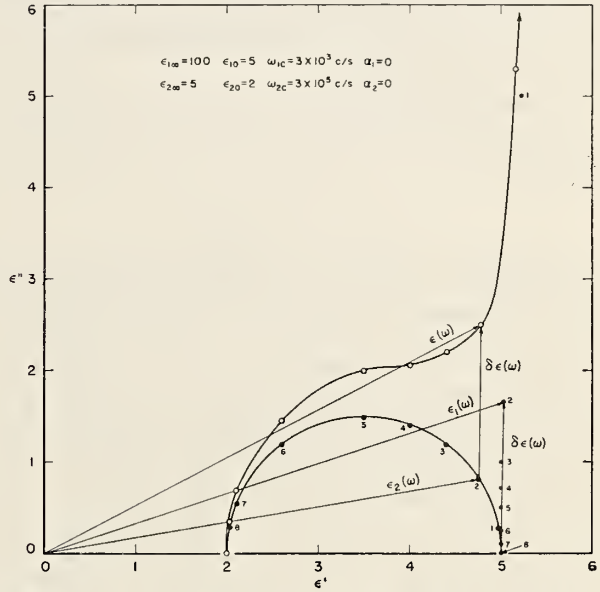

FIGURE 6. *A Cole-Cole plot for the case of two times of relaxation.*

The section of the plot that corresponds to low frequencies and the greater relaxation time is not drawn.

3. Representation of Dispersion Data for Dilute Solutions

3.1. Nonaqueous Solutions

3.11. *Cole-Cole Representation:* If the solvent has no loss then the dispersion equations in this representation are identical with those for the pure liquids, provided ϵ' and ϵ'' are replaced by the corresponding incremental dielectric constant and loss, $(\Delta\epsilon'/c)$ and $(\Delta\epsilon''/c)$. These quantities are defined by the relations

$$\epsilon_{12}'=\epsilon_1+\left(\frac{\Delta\epsilon'}{c}\right)\cdot c$$

$$\epsilon_{12}''=\left(\frac{\Delta\epsilon''}{c}\right)\cdot c$$

$$\tan\delta_{12}=\left(\frac{\Delta\tan\delta}{c}\right)\cdot c.$$

The subscripts 12 and 1 refer to the solution and solvent, respectively, c denotes the concentration, and δ the loss angle.

3.12. *Debye Representation:* This is the Cole-Cole representation for $\alpha=0$.

In those cases where only loss data were reported the critical wavelength was evaluated from one of the following equations:

$$\frac{\Delta\tan\delta}{c}=\frac{(\epsilon_1+2)^2}{\epsilon_1}\cdot\frac{4\pi}{27}\frac{N\mu^2}{kT}\cdot\frac{\omega\tau}{1+(\omega\tau)^2}$$

$$\frac{\Delta\epsilon''}{c}=\left\{\left(\frac{\Delta\epsilon}{c}\right)_\infty-\left(\frac{\Delta\epsilon}{c}\right)_0\right\}\cdot\frac{\omega\tau}{1+(\omega\tau)^2}.$$

3.2. Aqueous Solutions

The characteristic parameters listed in tables 5 and 6 are those of the Debye representation and have been determined for each solution.

4. Pure Liquids

Table 1. Dielectric dispersion parameters for pure inorganic liquids

Table 2. Dielectric dispersion parameters for pure organic liquids

Chemical Formulas and the Order of Listing Compounds

Formulas for the inorganic substances are written in the usual manner and are arranged in alphabetical sequence. Those for the organic substances are written with carbon first and hydrogen, if present, second. Symbols for the remaining elements then follow in alphabetical order. The order of listing the compounds is determined firstly by the number of carbon atoms, secondly by the number of hydrogen atoms, and finally by the symbols of the remaining elements taken in alphabetical order.

All compounds are listed in tables 1 and 2, and an ordinal number is assigned to each compound to facilitate finding it in other sections of the tables.

Dispersion Parameters

Treatment of data: The data for most substances are sufficiently limited in extent and lacking in confirmation to prevent an exact evaluation of the dispersion parameters. The supporting data referred to in tables 1 and 2 are very meager in many instances and consequently no attempt has been made to assign limits of accuracy to the derived quantities. The data of other authors are often inconsistent with the values given.

The parameters listed have been determined, when feasible, from Cole-Cole plots. If $\epsilon_{\lambda=0}$ is not given the corresponding quantity is n_D^2. In some instances $\epsilon_{\lambda=0}$ is the sum of n_D^2 and a small contribution from atomic polarization. The parameters of the Cole-Davidson representation are given for a small number of compounds.

Tabulated quantities:

$\epsilon_{\lambda=\infty}$ (or ϵ_∞) = the value of the complex dielectric constant $\epsilon=\epsilon'-i\cdot\epsilon''$ for $\lambda=\infty$.

$\epsilon_{\lambda=0}$ (or ϵ_0) = the value of ϵ for $\lambda=0$.

n_D^2 = the square of the refractive index for the sodium-D line.

α = the distribution parameter in the representation $\epsilon=\epsilon_0+(\epsilon_\infty-\epsilon_0)/[1+(i\cdot\lambda_c/\lambda)^{1-\alpha}]$.

β = the distribution parameter in the representation $\epsilon=\epsilon_0+(\epsilon_\infty-\epsilon_0)/(1+i\cdot\lambda_c/\lambda)^{\beta}$.

λ_c = the critical wavelength characteristic of the dispersion.

Notations:

ϵ_∞: Boldface type denotes values taken from the "Table of Dielectric Constants of Pure Liquids" by A. A. Maryott and E. R. Smith, NBS Circular 514. Other values are those given by the authors cited.

( ): Parentheses denote that the value given is considerably more uncertain than the estimated error characteristic of this quantity.

[ ]: Brackets denote that the value is assumed.

( ): Numbers in parentheses preceding the values listed for ϵ_0 denote the successive dispersion regions.

References and Bibliography: The references in tables 1 and 2 refer only to the work upon which the selected parameters depend. All references in tables 1 to 4, and the section on graphical data, are assembled in a bibliography at the end of table 4.

TABLE 1. *Dielectric dispersion parameters for pure inorganic liquids*

No.	Substance		t (°C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References	
1	D_2O	Deuterium oxide 99.5%	5	85.8	5.5		0	3.84	48.2	Collie.
			10	83.8	5.5		0	3.12		
			20	80.1	5.5	1.76	0	2.31		
			30	76.5	5.5		0	1.76		
			40	73.1	5.5		0	1.36		
			50	69.8	5.5		0	1.11		
			60	66.7	5.5		0	0.92_3		
2	H_2O	Water	0	[a]88.2	5.0		0	3.34	53	Hasted.
			10	84.0	5.0		0	2.43		
			20	80.4	5.2	1.78	0	1.78		
			30	76.5	5.2		0	1.36		
			40	73.1	5.6		0	1.10		
			50	70.7	5.8		0	0.91		
			60	66.2	5.9		0	.76		
			20	80.37		1.78	0	1.76	55	Poley.
									53	Hasted.
									53	Little.
									52	Saxton.
									48, 46	Collie.
									48	Abadie.
									39	Slevogt.
3	H_2SO_4	Sulfuric acid	20	(110)	5	(2.04)	0.09	90	53	Brand.

[a]Adjusted values.

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*

No.		Substance	t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References
		C_1							
1	$CBrCl_3$	Bromotrichloromethane	0 20 40 60	2.447 2.405 2.364 2.343		2.39 2.35 2.31 2.27	0.24 .19 .15 .03	0.8 .6 .5 .4	56.3 Smyth et al.
2	CBr_2Cl_2	Dibromodichloromethane	20 40 60	2.55 2.508 2.461		2.45 2.43 2.38	0 0 0	.65 .5 .35	56.3 Smyth et al.
3	CBr_2F_2	Dibromodifluoromethane	0 20	2.824 2.713		2.12 2.07	0.13 .10	.49 .43	56.3 Smyth et al.
4	CBr_3Cl	Tribromochloromethane	60	2.601		2.56	0	.6	56.3 Smyth et al.
5	CBr_3F	Tribromofluoromethane	0 20 40 60	3.092 2.996 2.902 2.822		2.55 2.50 2.46 2.41	0 0 0 0	1.49 1.15 0.96 .85	56.3 Smyth et al.
6	CCl_3F	Trichlorofluoromethane	0 20	2.374 2.303		2.03 1.99	0 0	.45 .38	56.3 Smyth et al.
7	CCl_4	Carbon tetrachloride	20	2.238		2.13		<.85	50 Whiffen. 47 Bleaney.
8	CS_2	Carbon disulfide	20	2.641		2.65		<.85	50 Whiffen. 47 Bleaney.
9	$CHCl_3$	Chloroform	25	4.718		2.08	[0]	(1.4)	43 Conner.
			−45.2	6.26		2.22	[0]	(4)	53 Sircar.
10	CH_2O_2	Formic acid							Table 4.
11	CH_3NO	Formamide	20	(110)	4.2	2.10	0	4.5	49 Burdun.
12	CH_4O	Methanol	−109.9[a] −103.2[a] −96.7 −86.0 −76.7	82.17 77.70 73.76 67.91 63.26	9.8 9.6 9.3 8.8 8.6		0 0 0 0 0	1.53×10^3 9.3×10^2 6.2×10^2 3.6×10^2 2.3×10^2	55 Denney.
			−10 0 10 20 30 40 50	40.37 37.98 35.75 33.64 31.65 29.73 28.03	6.3 6.1 5.9 5.7 5.5 5.2 5.0	 1.77	0 0 0 0 0 0 0	20.2 16.0 12.6 10.0 8.0 6.5 5.4	52 Lane. (55 Poley).
		C_2							
13	C_2Cl_4	Tetrachloroethylene							Table 4; Graphs.
14	$C_2H_3Cl_3$	1,1,1-Trichloroethane	4 20 40	7.71 7.20 6.57		2.10 2.08 2.06	0.05 .03 .01	1.25 1.04 0.84	56.2 Smyth et al.
			20	7.20		2.07	0	1.02	55 Poley.
15	C_2H_4BrCl	1-Bromo-1-chloroethane							Table 4.
16	$C_2H_4Br_2$	1,2-Dibromoethane	25 55	4.76 4.58	2.63 2.56	2.36 2.30	$.07_5$ $.03_3$	2.18 1.43	52 Smyth et al.
17	$C_2H_4Cl_2$	1,2-Dichloroethane	1 25 55	11.66 10.16 8.66	2.41 2.35 2.28	2.12 2.08 2.03	$.05_2$ $.04_0$ 0	1.83 1.31 0.85	52 Smyth et al.
18	$C_2H_4O_2$	Acetic acid							Table 4.

[a] Supercooled; mp, −97.7 (50 Timmermans).

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*—Continued

No.	Substance		t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References	
		C_2—Continued								
19	C_2H_5Br	Bromoethane	1	10.23	2.26	2.05	0.06_4	0.99	52	Smyth et al.
			25	9.20	2.20	2.01	$.05_6$	.38		
20	C_2H_5I	Iodoethane	25	7.69		2.28	[0]	(1.4)	43	Conner.
21	C_2H_6O	Ethanol	−142.6	79.0	8.0		0	5×10^5	55	Hassion; Graphs.
			−135.9	74.2	7.6		0	$1.6_7\times10^6$		
			−124.8	67.3	6.5		0	$3.9_7\times10^4$		
			−117.6	63.9	(6.0)		0	$2.0_6\times10^4$		
			−113.8	62.6	------		0	$1.6_2\times10^4$		
			−10	30.21	4.4_7		(0)	(62.0)	52	Lane.
			0	28.39	4.4_6		(0)	(48.6)		
			10	26.68	4.3_8		(0)	(35.0)		
			20	25.07	4.2_6	1.85	(0)	(27.0)		
			30	23.56	4.2_0		(0)	(21.2)		
			40	22.14	4.1_8		(0)	(16.7)		
			50	20.80	4.1_6		0	(13.3)		
22	$C_2H_6O_2$	Ethylene glycol	10	40.7	2.2_5		(0.14)	(30)	53	Yamamura.
			20	38.7	2.6_5	2.05	(.14)	(20)		
			30	36.7	3.1_0		(.23)	(15)		
			40	34.9	3.4_5		(.08)	(10)		
			25	41.3	5.4_8	2.01	.08	21	53	MIT.
		C_3								
23	C_3H_5Cl	3-Chloro-1-propene							Table 4.	
24	$C_3H_6Cl_2$	1,3-Dichloropropane	25	(10.2)		2.09	[0]	(1.6)	43	Conner.
25		2,2-Dichloropropane	2	12.58		2.03	0	1.47	56.2	Smyth et al.
			20	11.42		2.00	0	1.23		
			40	10.24		1.97	0	0.99		
26	$C_3H_6Cl_2O$	2,3-Dichloro-1-propanol							Graphs.	
27		1,3-Dichloro-2-propanol							Graphs.	
28	$C_3H_6N_2O_4$	2,2-Dinitropropane	60	35.0		2.00	0	2.6	56.2	Smyth et al.
29	C_3H_6O	Acetone	1	23.29	1.93		0.03	0.75	56.1	Smyth et al.
			20	21.20	1.90		0	.63		
			40	19.29	0.87		0	.52		
			20	21.20	2.5	1.85	[0]	.65	46	Abadie; Graphs.
30		2-Propen-1-ol (Allyl alcohol)							Table 4.	
31	$C_3H_6O_2$	Propionic acid							Table 4.	
32	$C_3H_6O_3$	1,3,5-Trioxane	65	15.55	1.92		0	1.4	56.4	Smyth et al.
			80	14.20	1.88		0	1.3		
33	C_3H_7Br	1-Bromopropane	1	8.90	2.27	2.09	0.08_7	1.53	52	Smyth et al.
			25	8.09	2.22	2.05	$.08_7$	1.09		
			55	7.09	2.15	2.00	$.03_3$	0.89		
34		2-Bromopropane	1	10.52	2.24	2.06	$.03_1$	1.26	52	Smyth et al.
			25	9.46	2.19	2.02	$.00_9$	0.99		
			55	8.14	2.12	1.97	0	.72		
35	C_3H_8O	1-Propanol	[b]−156	(2) 6.35	3.55		0	1.5×10^9	52	Cole.
				(3) 3.55	2.80		(0.3)	8.6×10^5		
			[b]−150	(1) (71.6)	5.80		0	2×10^9		
				(2) 5.80	(3.40)		(0.27)	7.1×10^6		
				(3) (3.40)	2.86		(.3)	1.2×10^6		

			[b]−145	(1) 67.4	5.70		0	3.6×10^8		
				(2) 5.70	3.56		(0.27)	1.7×10^6		
				(3) 3.56	2.94		(.3)	3×10^4		
			[b]−140	(1) 64.0	5.58		0	9.4×10^8		
				(2) 5.58	3.62		(0.27)	4.8×10^5		
			[b]−132	(1) 60.6	5.30		0	1.2×10^7		
				(2) 5.30	3.53		(0.27)	4.6×10^4		
			−120	(1) 55.2	5.20		0	1.22×10^6		
				(2) 5.20	3.55		(0.27)	6.7×10^3		
			−89.0	43.7	------		0	2.81×10^4	51	Davidson.
			−78.2	40.5	------		0	1.17×10^4		
			−64.4	36.8	------		0	4.51×10^3		
			−46.3	32.6	------		0	1.7×10^3		
			−60	(37.2)	(4.7)		(0.0_7)	(5.5×10^3)	28, 27	Mizushima.
			−40	(31.0)	(5.3)		$(.0_8)$	(1.3×10^3)		
			−20	(27.7)	(5.5)		$(.0_3)$	(4.7×10^2)		
			0	(25.0)	(6.0)		$(.0_2)$	(1.9×10^2)		
			18 to 20	20.8	2.65		(.04)	80	37	Abadie; Graphs.
			25	20.1	3.23	1.91	(.03)	70	53	MIT.
36		2-Propanol	[c]−95.7	47.1	4.0		0	19.2×10^4	55	Hassion.
			−90.0	44.5	3.9		0	8.95×10^4		
			−82.8	42.7	3.8		0	4.97×10^4		
			−73.2	39.5	(2.6)		0	2.25×10^4		
			−60	(37.8)	(4.1)		(0.1)	(6.8×10^3)	27	Mizushima.
			−40	(31.8)	(4.2)		(0)	(1.6×10^3)		
			−20	(28.2)	(5.6)		(0)	(7.5×10^2)		
			0	(24.4)	(6.7)		(0)	(2.3×10^2)		
			20	19.0	3.2	1.90	[0]	55	32 53	Girard; Graphs. Koizumi.
							[d] [β]			
37	$C_3H_8O_2$	1,2-Propanediol	−89.1	65.3	3.57		0.650	4.71×10^9	51	Davidson.
			−84.1	63.7	3.56		.664	7.73×10^8		
			−80.0	60.1	3.58		.663	1.70×10^8		
			−75.0	57.7	3.51		.662	3.56×10^7		
			−65.5	53.8	3.52		.666	3.17×10^6		
			−55.4	49.5	3.59		.664	3.98×10^5		
			−45.7	45.7	3.53		.663	7.26×10^4		
38		1,3-Propanediol							32	White; Graphs.
							[d] [β]			
39	$C_3H_8O_3$	Glycerol	−74.6	76.2	4.18		0.550	1.81×10^{11}	51	Davidson.
			−70	74.2	4.19		.566	2.35×10^{10}		
			−65.5	70.5	4.3		595	3.51×10^9		
			−60	67.4	4.16		.593	4.46×10^8		
			−50	63.9	4.10		.603	2.36×10^7		
			−40	60.4	4.16		.608	2.14×10^6		
		C_4								
40	C_4Cl_6	Hexachloro-1,3-butadiene	25	2.55	(2.46)		(0)	(10)	53	MIT.
41	C_4H_4O	Furan	1	3.095		(2.06)	0	0.41	55.1	Smyth et al.
			20	2.954		2.02	0	.33		
42	C_4H_4S	Thiophene	1	2.837		2.36	0.01	.60	55.1	Smyth et al.
			20	2.769		2.33	.01	.51		
			40	2.701		2.30	.01	.44		
			60	2.635		2.27	.09	.38		
43	C_4H_5N	Pyrrole	1	8.42		(2.31)	.14	1.98	55.1	Smyth et al.
			20	8.10		2.28	.09	1.47		
			40	7.76		2.25	.05	1.11		
			60	7.45		(2.22)	.03	0.91		
44	$C_4H_8Cl_2$	1,4-Dichlorobutane	1	9.64	2.35	2.15	$.09_1$	2.45	52	Smyth et al.
			25	8.90	2.30	2.11	$.08_2$	1.77		
			55	7.98	2.25	2.07	0	1.16		
45		1,2-Dichloroisobutane							Table 4.	

[b] Supercooled; mp, −126.1° C (50 Timmermans).
[c] Supercooled; mp, −89.5° C (50 Timmermans).
[d] $\epsilon=\epsilon_0+(\epsilon_\infty-\epsilon_0)/(1+\omega\tau)^\beta$.

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*—Continued

No.	Substance		t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References	
		C_4—Continued								
46	C_4H_8O	Tetrahydrofuran [e]	1	8.90		2.00	0.03	0.73	55.1	Smyth et al.
			20	8.20		1.98	.07	.54		
			40	7.60		1.95	.09	.42		
47		2-Butanone								Table 4.
48	$C_4H_8O_2$	Butyric acid								Table 4.
49		Ethyl acetate	3	6.40	2.48		.09	.90	52.8	Smyth et al.
			20	6.04	2.48	1.88	.06	.82		
			40	5.63	2.48		.04	.68		
			60	5.22	2.48		0	.58		
50	C_4H_9Br	1-Bromobutane	1	7.57	2.26	2.11	$.11_9$	2.11	52	Smyth et al.
			25	6.93	2.22	2.07	$.09_8$	1.64		
			55	6.24	2.16	2.02	$.07_8$	1.20		
51		1-Bromo-2-methyl-propane	1	7.82	2.26	2.11	$.03_5$	1.96	52	Smyth et al.
			25	7.18	2.21	2.06	$.03_2$	1.56		
			55	6.32	2.14	2.00	0	1.18		
52		2-Bromobutane	1	9.43	2.25	2.10	0	1.72	52	Smyth et al.
			25	8.64	2.20	2.06	0	1.34		
			55	7.65	2.14	2.01	0	1.03		
53		2-Bromo-2-methyl-propane	1	11.56	2.19	2.07	0.04_0	1.55	52	Smyth et al.
			25	10.30	2.17	2.03	$.03_2$	1.17		
			55	8.75	2.11	1.98	0	0.89		
54	C_4H_9Cl	1-Chlorobutane	25	7.24		1.96	[0]	(1.5)	43	Conner.
55		1-Chloro-2-methyl-propane								Table 4.
56		2-Chloro-2-methyl-propane	4	10.72		1.94	0	1.06	52.2	Smyth et al.
			20	9.87		1.92	0	0.90		
			40	8.90		1.89	0	.82		
			20	9.90		1.92	0	.80	55	Poley.
57	C_4H_9I	1-Iodobutane	25	6.12		2.24	[0]	(3.5)	43	Conner.
58	C_4H_9N	Pyrrolidine	1	9.29		(2.101)	0.18	4.0	55.1	Smyth et al.
			20	8.30		2.07	.15	2.45		
			40	7.36		2.05	.11	1.50		
			60	6.60		2.03	.07	1.10		
59	$C_4H_{10}O$	1-Butanol	[f] −138.4	(1) 59	4.8		0	1.19×10^9	55	Dannhauser.
				(2) 4.8	3.3		(0.22)	4.3×10^6		
			[f] −131.9	(1) 54.7	4.6		0	1.81×10^8		
				(2) 4.6	3.2		(0.22)	6.2×10^5		
			[f] −127.2	(1) 52.6	4.4		0	5.08×10^7		
				(2) 4.4	3.2		(0.22)	1.43×10^5		
			[f] −117.4	(1) 49.1	4.4		0	5.88×10^6		
				(2) 4.4	3.1		(0.22)	1.51×10^4		
			[f] −99.9	41.7	4.1		0	3.22×10^5		
			−82.3	36.3	3.8		0	4.28×10^4		
			−64.3	32.4	3.7		0	1.04×10^4		
			−45.8	28.5	3.6		0	2.64×10^3		
			−26.6	25.1	3.5		0	1.11×10^3		
			−3.7	21.0	3.2		0	3.40×10^2		
			−25	23.8	3.8		0	1.22×10^3	54	Reinisch.
			0.7	20.6	3.1		0	2.58×10^2		
			(19)	17.9	3.15		0.03	100	39	Slevogt.
			25	17.1	2.95	1.95	.08	90	53	MIT.

60		2-Butanol	[g] −121.2	54.6	4.4		0	3.8×10^{8}	55	Dannhauser; Graphs.
			−107.3	48.6	4.2		0	1.45×10^{7}		
			−92.8	43.3	4.1		0	1.27×10^{6}		
			−73.2	37.2	4.0		0	1.07×10^{5}		
			−55.4	32.3	------		0	1.75×10^{4}		
			−28.4	26.0	------		0	5.7×10^{3}		
			−3.5	21.4	------		0	4.9×10^{2}		
			20	15.8	3.5	1.95	(0)	(95)	44	Benoit.
61		2-Methyl-1-propanol	[h] −137.0	(1) 56	5.5		0	8.3×10^{9}	55	Dannhauser.
				(2) 5.5	3.5		(0.22)	2.13×10^{8}		
			[h] −127.5	(1) 51.8	4.8		0	4.30×10^{8}		
				(2) 4.8	3.4		(0.22)	7.2×10^{6}		
			[h] −120.1	(1) 48.8	4.5		0	6.45×10^{7}		
				(2) 4.5	3.4		(0.22)	8.7×10^{5}		
			[h] −110.1	(1) 44.9	4.3		0	7.08×10^{6}		
				(2) 4.3	3.2		(0.22)	9.6×10^{4}		
			−95.6	40.4	4.4		0	6.73×10^{5}		
			−82.3	36.6	4.0		0	1.20×10^{5}		
			−68.3	32.2	3.4		0	3.03×10^{4}		
			−41.6	27.6	3.1		0	4.0×10^{3}		
			−28.0	25.2	2.9		0	1.73×10^{3}		
			−0.7	20.8	2.7		0	4.50×10^{2}		
			.7	21.3	3.1		0	340	54	Reinisch.
			20	18.5	3.1	1.95	0	150	46 33 32	Häfelin. Szymanowski. Girard; Graphs.
62		2-Methyl-2-propanol								Table 4.
63		Ethyl ether	4	4.70	------	1.85	0	0.53	56.6	Smyth et al.
			25	4.24	------	1.82	0	.41		
		C_5								
64	C_5H_5N	Pyridine	1	14.65	2.32		0.04	1.69	55.1	Smyth et al.
			20	13.55	2.30	2.28	0	1.37		
			40	12.45	2.28		0	1.12		
			60	11.44	2.26		0	0.90		
65	$C_5H_{10}O$	3-Pentanone								Table 4.
66	$C_5H_{11}Br$	1-Bromopentane	1	6.88	2.26	2.12	0.17_7	2.33	52	Smyth et al.
			25	6.31	2.22	2.08	$.14_3$	2.28		
			55	5.70	2.16	2.04	$.11_8$	1.65		
67		1-Bromo-3-methyl-butane	25	5.93		2.07	[0]	(2.7)	43	Conner.
68	$C_5H_{11}Cl$	1-Chloro-3-methyl-hutane	25	5.94		1.98	[0]	(1.8)	43	Conner.
69		2-Chloro-2-methyl-hutane	25	(9.1)		1.86	[0]	(1.3)	43	Conner.
70	$C_5H_{12}O$	1-Pentanol	0.7	17.2	3.4		0	405	54	Reinisch.
			20	15.3	3.8		[0]	(140)	44	Benoit.
71		3-Methyl-1-butanol	−100	35.2	4.4		0.05	4.75×10^{6}	54	Reinisch.
			−90	33.2	4.0		.11	9.24×10^{5}		
			−80	30.6	3.5		0	2.6×10^{5}		
			−36.5	23.8	3.2		0	5.0×10^{3}		
			−18	21.2	3.2		0	1.5×10^{3}		
			0.7	18.0	3.2		0	4.55×10^{2}		
			20	15.7	3.2		0	155	53	Brot; Graphs.
72		2-Methyl-2-hutanol								Table 4.
		C_6								
73	$C_6H_4Cl_2$	o-Diehlorohenzene								Table 4.
74	C_6H_5Br	Bromohenzene	1	5.74	2.51	2.47	0.11_0	4.53	52	Smyth et al.
			25	5.39	2.46	2.43	$.09_7$	3.09		
			55	4.96	2.40	2.37	$.06_9$	2.15		
			22	5.43	2.62		0	3.20	55	Poley.

[e] May eontain 1 pereent of water. [f] Supereooled; mp, −89° C (50 Timmermans). [g] Supereooled; mp, (−115° C). [h] Supereooled; mp, (−108° C).

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*—Continued

No.	Substance		t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References	
		C_6—Continued								
75	C_6H_5Cl	Cblorobenzene	1 25 55	6.15 5.63 5.09	2.40 2.35 2.29	2.36 2.32 2.26	0.10_0 $.04_8$ $.01_8$	2.77 1.94 1.37	52	Smyth et al.
			22	5.69	2.56		0	2.22	55	Poley.
76	C_6H_5ClO	*p*-Chlorophenol							Table 4.	
77	C_6H_5F	Fluorohenzene	21	5.44	2.33	2.15	0	1.05	55	Poley.
78	C_6H_5I	Iodobenzene	21	4.64	2.76	2.62	0	5.13	55	Poley.
79	$C_6H_5NO_2$	Nitrobenzene	20	35.74	4.07		0	8.6	55	Poley.
			20	35.74		2.40	[0]	(9)	43	Girard; Grapbs.
80	C_6H_6	Benzene							Tahle 4; Graphs.	
81	C_6H_6O	Phenol							Table 4.	
82	C_6H_7N	Aniline	20	6.89		2.52	[0]	(3.7)	49	Fisber.
83		γ-Picoline	1 20 40 60	(13.1) (12.2) (11.3) (10.5)		2.30 2.27 2.24 2.21	0.08 .05 .03 0	3.2 2.51 1.98 1.53	55.1	Smyth et al.
84	$C_6H_{10}O$	Cyclohexanone	1 20 40 60	17.01 16.00 14.99 13.99	2.21 2.18 2.15 2.13		0.11 .11 .11 .10	2.71 1.95 1.55 1.23	56.1	Smytb et al.
			21				0	2.6	56	Dieringer.
85	$C_6H_{11}Br$	Bromocyclohexane	1 25 55	8.54 7.92 7.18	2.43 2.38 2.33	2.27 2.23 2.18	0.17_7 $.10_8$ $.07_3$	5.90 3.67 2.45	52	Smyth et al.
			21	8.02		2.23	0	4.5	56	Dieringer.
86	$C_6H_{11}Cl$	Chlorocyclohexane	21				0	2.7	56	Dieringer.
87	$C_6H_{11}NO_2$	Nitrocyclohexane	21				0	4.4	56	Dieringer.
88	C_6H_{12}	Cyclohexane							Table 4; Graphs.	
89	$C_6H_{12}O$	Cyclohexanol	25 45	(1) 16.8 (2) 4.3 (1) 15.3 (2) 4.1	4.3 3.5 4.1 3.4	2.15	0 0 0 0	458 30 143 12.5	56	Arnoult.
			25	16.8	3.2		0	460	53	Reinisch.
90	$C_6H_{12}O_3$	Paraldehyde	20 40 60	14.70 12.25 10.30	2.27 2.25 2.23	1.97	0.05 .07 .10	20 12.6 8.2	56.4	Smyth et al.
91	$C_6H_{13}Br$	1-Bromobexane	1 25 55	6.30 5.82 5.30	2.25 2.21 2.17	2.13 2.08 2.04	$.18_9$ $.17_2$ $.14_8$	4.38 2.96 2.00	52	Smyth et al.
92	C_6H_{14}	1-Hexane	20	1.890		1.89		<1.4	47	Bleaney.
93	$C_6H_{14}O$	1-Hexanol	−40 −25 0.7	19.7 17.7 15.0	3.6 3.3 3.0		0 0 0	5.12×10^3 2.5×10^3 5.55×10^2	54	Reiniscb.
			20	(1) 12.9 (2) 3.2	3.3 2.34	2.00	0 0	197 4	52	Bruma.

94	$C_6H_{14}O_2$	2-Methyl-2,4-pentanodiol							Graphs.
95	$C_6H_{14}O_6$	Sorbitol							Table 4.
96	$C_6H_{18}OSi_2$	Hexamethyldisiloxane	−60	2.422	2.21		0.4	(0.15 to 0.36)	55.2 Smyth et al.
			−40	2.353	2.26		.2	(0.10 to 0.16)	
			−20	2.290	2.14		.2	0.13	
			2	2.227	2.06	1.89	.2	.11	
			20	2.179	2.06		0	.14	
			40	2.130	------		0	.10	
		C_7							
97	C_7H_5N	Benzonitrile	21	25.6	3.85	2.34	0	7.14	55 Poley.
98	C_7H_7Cl	Benzyl ebloride							Tablo 4.
99	C_7H_8	Toluene	(20)	2.391		2.24	[0]	(1.4)	46 Dunsmuir.
100	C_7H_8O	Benzyl alcobol							Table 4; Graphs.
101		Methoxybenzene (Anisole)	25	4.33		2.29	[0]	(1.8)	53 Fisher.
102		*o*-Cresol							Table 4.
103		*m*-Cresol							Tablo 4.
104		*p*-Cresol							Table 4.
105	$C_7H_8O_2$	*o*-Metboxyphenol							Table 4.
106	C_7H_9N	*m*-Toluidine	20	6.190		2.47	[0]	(6.5)	49 Fisher.
107		Benzylamine							Table 4.
108	$C_7H_{14}O$	2-Heptanone	25	11.7	2.5	1.96	0.0	2.1	56.6 Smyth et al.
			50	10.4	2.4		.0	1.5	
			75	9.3	2.3		.0	1.1	
			1	13.01	2.08		.12	2.88	56.1 Smyth et al.
			20	11.98	2.05		.07	2.04	
			40	11.02	2.03		.06	1.55	
			60	10.18	2.00		.05	1.15	
109		4-Heptanone	1	13.82	2.07		.09	3.26	56.1 Smyth et al.
			20	12.67	2.05		.07	2.35	
			40	11.61	2.02		.08	1.67	
			60	10.71	2.00		.10	1.35	
110		5-Metbyl-3-hexanone							Table 4.
111	$C_7H_{14}O_2$	Isoamyl aeetate	20	4.72	2.31	(1.96)	.10	1.6	52.8 Smyth et al.
			50	4.34	2.31		.08	1.2	
112	$C_7H_{15}Br$	1-Bromoheptane	1	5.74	2.25	2.13	.22$_0$	5.74	52 Smyth et al.
			25	5.33	2.21	2.10	.20$_4$	3.61	
			55	4.90	2.17	2.06	.18$_0$	2.35	
113	C_7H_{16}	1-Heptane							Tablo 4.
114	$C_7H_{16}O$	1-Heptanol	−34	17.5	3.3		0	6×10^4	51 Oppenbeim.
			0	13.7	3.3		0	7.1×10^2	
			25	11.1	3.3	2.02	0	2.3×10^2	
			50	9.0	3.3		0	79	
			20	(1) 11.7	3.10		0	2.72×10^2	55 Lebrun.
				(2) 3.10	2.35		0	4.3	
		C_8							
115	C_8H_8O	Acetophenone	20	18.66	2.45		0.28	7.4	56.1 Smyth et al.
			40	17.77	2.42		.25	6.0	
			60	16.88	2.39		.23	4.8	
			25	17.39		2.35	[0]	(9.8)	53 Fisher.
116	C_8H_{10}	*o*-Xylene	(20)	2.568		2.27	[0]	(1.8)	46 Wbiffen.
117		*m*-Xylene							Table 4.

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*—Continued

No.		Substance	t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References
		C_8—Continued							
118		Ethyl benzene							Table 4.
119	$C_8H_{11}N$	2,4,6-Trimethyl-pyridine (γ-Collidine)	20 40 60	8.00 7.46 6.94	2.50 2.40 2.34	2.24	0.08 .09 .10	7.6 6.2 4.4	56.4 Smyth et al.
120	$C_8H_{16}O_2$	Octanoic acid (Caprylic acid)							Table 4.
121	$C_8H_{17}Br$	1-Bromooctane	1 25 55	5.32 5.00 4.60	2.25 2.21 2.17	2.14 2.11 2.07	$.24_8$ $.22_6$ $.22_0$	6.78 4.09 2.58	52 Smyth et al.
122	$C_8H_{17}Cl$	1-Chlorooctane	1 25 55	5.47 5.05 4.55	2.20 2.15 2.10	2.08 2.04 2.00	$.22_4$ $.20_6$ $.18_0$	5.12 3.22 1.94	52 Smyth et al.
123	$C_8H_{17}I$	1-Iodooctane	1 25 55	4.90 4.62 4.27	2.37 2.33 2.28	2.24 2.21 2.16	$.20_4$ $.19_7$ $.19_1$	12.10 7.24 4.22	52 Smyth et al.
124	$C_8H_{17}DO$	1-Octanol-D-1	−15.5 0 25 49				0 0 0 0	2.50×10^3 1.07×10^3 273 (100)	52 Corval; Graphs.
125	$C_8H_{18}O$	1-Octanol	−15.5 0.7 25 49	13.40 12.00 9.8 7.80	3.10 2.10 3.10 3.10	 2.04 	0.05 0 0 0	2.07×10^3 9.5×10^2 2.56×10^2 78.9	53 Dalbert; Graphs.
			20	(1) 10.35 (2) 3.05	3.05 2.35	2.03	0 0	330 53	55 Lebrun
126		2-Octanol	−36 −20 0.7 25 49	16.50 13.70 10.50 7.85 5.93	2.80 2.80 2.80 2.80 2.80	 2.04 	0.07_7 $.06_6$ $.05_5$ 0 0	3.85×10^4 7.73×10^3 1.20×10^3 222	53 Dalbert; Graphs.
127		Butyl ether							Table 4; Graphs.
		C_9							
128	C_9H_7N	Quinoline	1 20 40 60	9.70 9.03 8.40 7.81		2.65 2.63 2.61 2.58	0.11 .09 .07 .07	14.5 8.4 5.63 3.72	55.1 Smyth et al.
129		Isoquinoline	25 40 60	10.43 9.88 9.22		2.62	.13 .11 .08	12.4 8.52 5.63	55.1 Smyth et al.
130	$C_9H_{19}Br$	1-Bromononane	1 25 55	5.01 4.74 4.40	2.24 2.21 2.17	2.15 2.11 2.07	$.24_6$ $.24_3$ $.22_7$	9.10 5.36 2.97	52 Smyth et al.
131	$C_9H_{20}O$	1-Nonanol	20	(1) 9.05 (2) 3.05	3.05	2.05	0 0	375 8.6	55 Lebrun; Graphs.
		C_{10}							
132	$C_{10}H_7Br$	1-Bromonaphthalene	20.5	4.9	2.75		0	12	51 Meekbach.
			25 55	4.83 4.57	2.80 2.75	2.74 2.69	0.16_1 $.10_3$	16.20 8.02	52 Smyth et al.
133	$C_{10}H_7Cl$	1-Chloronaphthalene	1 25 55	5.30 5.04 4.72	2.76 2.71 2.65	2.71 2.66 2.60	$.18_2$ $.08_4$ $.06_9$	20.50 9.24 5.23	52 Smyth et al.
134	$C_{10}H_{12}O_2$	Eugenol	20	9.31		2.37	[0]	(57)	52 Fischer.
135	$C_{10}H_{14}$	1-Methyl-4-isopropylbenzene (*p*-cymene)	20	2.243		2.22	[0]	(1.8)	46 Whiffen.

136	$C_{10}H_{16}O$	Citral								Table 4; Graphs.
137	$C_{10}H_{16}O_2$	Geranic acid								Table 4; Graphs.
138	$C_{10}H_{18}$	*trans*-Decahydronaphthalene								Table 4; Graphs.
139	$C_{10}H_{18}O$	Geraniol								Table 4; Graphs.
140	$C_{10}H_{21}Br$	1-Bromodecane	1	4.75	2.24	2.15	0.27_3	13.10	52	Smyth et al.
			25	4.44	2.21	2.11	$.25_1$	6.32		
			55	4.12	2.16	2.07	$.22_9$	3.60		
141	$C_{10}H_{21}Cl$	1-Chlorodecane								Table 4.
142	$C_{10}H_{22}O$	1-Decanol	20	(1) 7.75	3.10	2.07	0	313	55	Lebrun.
				(2) 3.10	2.40		0	10		
		C_{11}								
143	$C_{11}H_{24}O$	1-Undecanol	25	(1) 6.45	2.94	2.07	0	290	55.1	Lebrun.
				(2) 2.94	2.42		0	8		
		C_{12}								
144	$C_{12}F_{26}O$	Perfluorodihexyl ether								Table 4.
145	$C_{12}F_{27}N$	Heptacosafluorotributyl amine								Table 4.
146	$C_{12}H_9Cl$	3-Chlorobiphenyl								Table 4.
147	$C_{12}H_{10}O$	2-Acetonaphthone	60	13.03	2.65		0.09	31	56.1	Smyth et al.
			70	12.49	2.63		.05	23		
			80	12.15	2.61		.07	19		
			90	12.01	2.59		.11	17		
148		Phenyl ether	40	3.61	2.57		.12	1.11	56.1	Smyth et el.
			60	3.47	2.54		.08	0.84		
			80	3.35	2.51		.05	.68		
149	$C_{12}H_{20}O_2$	Geranyl acetate								Table 4.
150	$C_{12}H_{24}O_2$	Dodecanoic acid (Lauric)								Table 4; Graphs.
151	$C_{12}H_{25}Br$	1-Bromododecane	1	4.31	2.23	2.14	$.29_3$	19.20	52	Smyth et el.
			25	4.07	2.19	2.11	$.25_9$	9.20		
			55	3.80	2.15	2.07	$.23_2$	4.59		
152	$C_{12}H_{25}Cl$	1-Chlorododecane	1	4.45	2.20	2.11	$.26_0$	11.50	52	Smyth et el.
			25	4.17	2.17	2.08	$.24_7$	5.92		
			55	3.85	2.13	2.04	$.18_8$	3.35		
153	$C_{12}H_{26}O$	1-Dodecanol								Table 4.
		C_{13}								
154	$C_{13}H_{10}O$	Benzophenone	50	[i] 11.9	2.94	2.56	.26	15.4	56.6	Smyth et al.
			73	10.85	2.94		.17	8.8		
			85	10.13	2.94		.14	7.4		
			60	[j] 10.91	2.64		.04	13	56.1	Smyth et al.
			70	10.54	2.63		.03	10		
			80	10.23	2.61		.04	8.3		
			90	9.99	2.60		.06	7.0		
155	$C_{13}H_{26}O_2$	Methyl laurate								Table 4.
		C_{14}								
156	$C_{14}H_{29}Br$	1-Bromotetradecane	1	4.04	2.24	2.16	$.29_9$	23.30	52	Smyth et al.
			25	3.84	2.20	2.12	$.27_0$	10.10		
			55	3.61	2.16	2.08	$.34_5$	5.26		
157	$C_{14}H_{30}O$	1-Tetradecanol								Table 4.

[i] mp, 48.2 [mp, 48.1 (50 Timmermans)].
[j] mp, 47.4.

TABLE 2.—*Dielectric dispersion parameters for pure organic liquids*—Continued

No.	Substance		t (° C)	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	n_D^2	α_{Cole}	λ_c (cm)	References
		C_{15}							
158	$C_{15}H_{30}O$	8-Pentadecanone	50	6.4	2.3	2.05	0.11	6.2	56.6 Smytb et al.
			65	6.2	2.3		.11	4.7	
			80	5.64	2.3		.10	4.7	
159	$C_{15}H_{30}O_2$	Methyl myristate							Table 4.
		C_{16}							
160	$C_{16}H_{32}O_2$	Hexadecanoic acid (Palmitic)							Table 4.
161	$C_{16}H_{33}Br$	1-Bromohexadecane	25	3.68	2.21	2.13	$.28_7$	13.10	52 Smyth et al.
			55	3.46	2.17	2.10	$.24_8$	5.78	
162	$C_{16}H_{33}Cl$	1-Cblorohexadecane							Table 4.
163	$C_{16}H_{34}O$	1-Hexadecanol							Table 4; Graphs.
		C_{17}							
164	$C_{17}H_{34}O$	9-Heptadecanone	55	5.5	2.3	2.05	.09	6.0	56.6 Smyth et al.
			70	5.2	2.3		.08	4.6	
			85	4.9	2.3		.07	3.6	
165	$C_{17}H_{34}O_2$	Methyl palmitate							Table 4; Graphs.
		C_{18}							
166	$C_{18}H_{32}O_2$	Linoleic acid							Table 4.
167	$C_{18}H_{34}O_2$	Oleic acid							Table 4.
168	$C_{18}H_{34}O_4$	Dibutyl sebacate							Table 4.
169	$C_{18}H_{36}O_2$	Ethyl palmitate							Table 4; Graphs.
170		Cetyl acetate	35	3.19	2.24	2.06	.29	2.5	52.8 Smyth et al.
			55	3.09	2.23		.26	2.1	
			75	2.99	2.25		.24	1.7	
171	$C_{18}H_{38}O$	1-Octadecanol							Table 4.
		C_{20}							
172	$C_{20}H_{40}O$	Phytol							Table 4; Graphs.
173	$C_{20}H_{40}O_2$	Octadecyl acetate	35	3.07	2.23		.29	2.8	52.8 Smyth et al.
			55	2.98	2.23	2.05	.24	2.2	
			75	2.89	2.23		.19	1.8	
174	$C_{20}H_{42}O$	Di-dihydrocitronellyl ether							Table 4; Graphs.
175	$C_{20}H_{42}O_2$	Decyl etber	20	2.644		2.08	(.7)	(6.5)	56.6 Smyth et al.
			40	2.565			(.7)	(4.4)	
		C_{21}							
176	$C_{21}H_{42}O_4$	Monostearin	80	4.84	2.58		.22	8.3	52.8 Smyth et al.
			90	4.74	2.53	2.07	.24	6.9	
		C_{22}							
177	$C_{22}H_{34}O_2$	Ethyl abietate							Table 4.
178	$C_{22}H_{42}O_2$	Pbytyl acetate							Table 4; Grapbs.
		C_{26}							
179	$C_{26}H_{50}O_4$	Dioctyl sebaeate							Table 4.

		C_{28}							
180	$C_{28}H_{56}O_2$	Decyl stearate	40 60 80	2.81 2.73 2.65	2.16 2.15 2.15	 2.04	.34 .26 .14	5.8 4.5 3.5	52.8 Smyth et al.
		C_{30}							
181	$C_{30}H_{58}O_4$	Ethylene dimyristate	70	2.98	2.19	2.05	.21	2.5	52.8 Smyth et al.
182	$C_{30}H_{60}O_2$	Tetradecyl palmitate	50	2.66	2.17	2.05	.24	4.5	52.8 Smyth et al.
		C_{32}							
183	$C_{32}H_{64}O_2$	Tetradecyl stearate	50 82	2.67 2.57	2.15 2.16		.14 .36	(4) (2.3)	52.8 Smyth et al.
		C_{34}							
184	$C_{34}H_{66}O_4$	Ethylene dipalmitate	75	2.89	2.23		.22	3.0	52.8 Smyth et al.
185	$C_{34}H_{68}O_2$	Cetyl stearate	60 80	2.61 2.54	2.13 2.13	 2.06	.28 .13	3.8 2.7	52.8 Smyth et al.
		C_{38}							
186	$C_{38}H_{74}O_4$	Ethylene distearate	80	2.79	2.26		.22	3.4	52.8 Smyth et al.
		C_{39}							
187	$C_{39}H_{76}O_5$	Distearin	80 90	3.25 3.22	2.30 2.36	 2.07	.31 .30	6.6 4.7	52.8 Smyth et al.
		C_{51}							
188	$C_{51}H_{98}O_6$	Tripalmitin							Table 4.
		C_{57}							
189	$C_{57}H_{104}O_6$	Triolein							Table 4.
190	$C_{57}H_{110}O_6$	Tristearin	80 90	2.74 2.73_5	2.18 2.18	 2.07	.47 .47	7.8 7.8	52.8 Smyth et al.

Table 3. Dielectric dispersion data for pure inorganic liquids

Table 4. Dielectric dispersion data for pure organic liquids

Tabulated Quantities: In general, the real and imaginary parts of the complex dielectric constant $\epsilon=\epsilon'-i\cdot\epsilon''$ are listed. For a few compounds the data are given, in part, as the real and imaginary parts of the complex refractive index $n^*=n-i\cdot\kappa$. The relation between ϵ and n^* is $\epsilon=n^{*2}$.

TABLE 3. *Dielectric dispersion data for pure inorganic liquids*

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
1	D_2O	Deuterium oxide (99.5%)	5	∞	85.87		48	Collie.
				10.0	------	1.52(κ)[a]		
				3.213	38.44	38.7		
				1.27	15.48	25.3		
			10	∞	83.89			
				10.0	------	1.27(κ)		
				3.213	45.34	38.5		
				1.27	18.39	28.2		
			20	∞	80.08			
				10.0	------	0.94(κ)		
				3.213	55.42	35.2		
				1.27	23.85	32.1		
			30	∞	76.47			
				10.0	------	0.71(κ)		
				3.213	60.26	29.5		
				1.27	31.77	33.8		
			40	∞	73.04			
				10.0	------	0.54(κ)		
				3.213	61.52	23.5		
				1.27	38.44	34.0		
			50	∞	69.78			
				10.0	------	0.43(κ)		
				3.213	62.17	19.6		
			60	∞	66.68			
				10.0	------	0.34(κ)		
				3.213	62.93	16.6		
			25 to 40	467			49	Fischer.
			(20)	23.6 to 451			40	Divikovsky.
2	H_2O	Water	0	∞	88.15		53	Halsted.
				9.22	80.0	26.5		
				3.282	46.0	41.0		
				1.267	14.5	27.5		
			10	∞	84.15			
				9.22	79.3	19.4		
				3.282	56.0	37.0		
				1.267	22.0	33.0		
			20	∞	80.36			
				9.22	77.8	13.9		
				3.282	63.0	31.5		
				1.267	31.0	35.0		
			30	∞	76.77			
				9.22	75.8	10.2		
				3.282	65.8	26.0		
				1.267	38.7	35.5		
			40	∞	73.35			
				9.22	73.0	8.4		
				3.282	66.3	20.5		
				1.267	43.5	34.0		
			50	∞	70.10			
				9.22	69.7	6.5		
				3.282	65.5	16.5		
				1.267	48.0	31.0		
			60	∞	67.00			
				9.22	66.0	5.0		
				3.282	63.5	13.5		
				1.267	50.5	26.5		
			1.5	∞	87.54		53	MIT.
				3×10^3	87.0	0.17		
				300	87.0	.61		
				100	86.5	2.77		
				10	80.5	25.0		
				3	38.0	39.1		

[a] κ=absorption coefficient.

Table 3. *Dielectric dispersion data for pure inorganic liquids*—Continued

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
		5	∞	86.13		
			100	85.2	2.3	
			10	80.2	22.1	
			3	41.	39.0	
		15	∞	82.23		
			100	81.0	1.7	
			10	78.8	16.2	
			3	49.	34.3	
		25	∞	78.54		
			3×10^3	78.2	0.36	
			300	78.	.39	
			100	77.5	1.24	
			10	76.7	12.0	
			3	55.	29.7	
		35	∞	75.04		
			100	74.0	0.93	
			10	74.0	9.4	
			3	58.	25.5	
		45	∞	71.70		
			100	71.0	0.75	
			10	70.7	7.5	
			3	59.	23.6	
		55	∞	68.53		
			100	68.	0.63	
			10	67.5	6.0	
			3	60.	21.6	
		65	∞	65.51		
			100	64.5	0.54	
			10	64.0	4.9	
			3	59.0	18.9	
		75	∞	62.62		
			100	61.	0.47	
			10	60.5	4.0	
			3	57.	16.0	
		85	∞	59.85		
			300	58.	0.17	
			100	57.	.42	
			10	56.5	3.1	
			3	54.	14.0	
		95	∞	57.19		
			100	52.	0.36	
			10	52.	2.4	
		0	10.0	79.66	24.7	48 Collie.
			3.21	44.82	41.6	
			1.27	16.22	28.3	
		10	10.0	78.07	17.5	
			3.21	53.85	37.6	
			1.27	22.33	32.3	
		20	10.0	77.42	13.1	
			3.21	61.41	31.8	
			1.27	30.88	35.8	
		30	10.0	76.78	9.8	
			3.21	63.31	25.5	
			1.27	38.43	36.0	
		40	10.0	72.56	7.54	
			3.21	65.58	21.2	
			1.27	43.24	33.6	
		50	10.0	68.44	5.80	
			3.21	63.13	17.1	
			1.27	48.26	30.6	
		60	10.0	65.37	4.55	
			3.21	63.09	13.8	
			1.27	49.79	27.3	
		75	10.0	60.49	3.30	
			3.21	60.70	10.5	
			1.27	51.71	22.3	
		0	1.58	19.1	30.4	46 Saxton.
			1.24	14.5	25.6	
		5	1.58	25.3	34.7	
			1.24	19.1	30.3	
		10	1.58	31.9	37.0	
			1.24	24.4	33.5	
		15	1.58	38.2	37.6	
			1.24	29.8	35.5	
		20	1.58	44.1	37.2	
			1.24	35.0	36.2	

Table 3. *Dielectric dispersion data for pure inorganic liquids*—Continued

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
		25	1.58	48.8	35.8	
			1.24	39.9	36.0	
		30	1.58	52.7	33.5	
			1.24	44.2	35.2	
		35	1.58	55.6	31.0	
			1.24	48.0	33.6	
		40	1.58	57.8	28.1	
			1.24	51.3	31.5	
		(20)	501	80.8	0.28	49 Burdun.
			436	80.2	----------	
			308	80.4	.45	
			216	80.4	.63	
			101	80.3	1.27	
			89.8	80.0	1.44	
			64.5	79.5	1.95	
			41.0	79.0	2.8	
			23.6	78.7	5.3	
			8.4	74.0	14.3	
			5.1	67.0	22.0	
			3.2	56.7	34.0	
			1.6	40.0	39.0	
		18.6	246	80.8	0.6	39 Slevogt.
		18.9	58.3	80.8	2.8	
		18.1	16.2	80.7	10.2	
		19.5	10.44	78.6	12.1	
		21	11.12	78.5	12.2	53 Little.
			10.57	78.1	13.0	
			10.00	78.0	13.5	
			9.75	77.6	14.0	
			9.16	77.0	14.8	
		19	9.35	78.0	12.1	39 Bäz.
			6.10	73.2	18.1	
			3.58	61.8	26.5	
			2.8	55.3	33.9	
				(n) [b]	(κ) [a]	
		−8	1.24	----------	2.55	52 Lane.
			0.62	----------	1.77	
		0	3.21	----------	2.89	
			1.24	4.75	2.77	
			0.62	----------	2.04	
		10	3.21	----------	2.44	
			1.24	5.45	2.90	
			0.62	----------	2.37	
		20	3.21	----------	2.00	
			1.24	6.15	2.86	
			0.62	----------	2.59	
		30	3.21	----------	1.60	
			1.24	6.70	2.67	
			0.62	----------	2.70	
		40	3.21	----------	1.29	
			1.24	7.10	2.41	
			0.62	----------	2.70	
		50	3.21		1.08	
			1.24	7.30	2.13	
			0.62		2.63	
				(n) [b]		
		17	10.4	9.0		47 Lindeman.
			4.6	8.77		
			2.5	8.41		
			1.5	7.84		
			0.66	6.02		
			.24	3.63		
			.10	2.62		
			.05	2.22		
			.014	2.15		
				(n) [b]		
		18	56.7	8.92		36 Ardenne.
			53.0	8.97		
			50.0	8.96		
			46.0	8.96		
			33.4	8.92		
			31.0	8.92		
			29.0	8.95		
			13.45	8.80		
		20	3.99	70.1	24.6	55 Poley.
			3.55	67.7	27.1	
			3.20	61.8	32.0	
			1.25	31.5	35.5	
			0.802	21.34	29.6	
		(20?)	83.6	80.2	2.5	55.1 Yamamura.

[a] κ=absorption coefficient. [b] n=refractive index.

TABLE 3. *Dielectric dispersion data for pure inorganic liquids*—Continued

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
		0	10.00	79.7	24.7	46 Collie.
		5		80.0	20.7	
		10		78.1	17.4	
		15		77.6	15.0	
		20		77.4	13.1	
		25		77.2	11.1	
		30		76.8	9.8	
		35		75.5	8.5	
		40		72.6	7.5	
		50		68.4	5.7	
		60		64.7	4.5	
		70		61.9	3.6	
		80		59.4	3.1	
		90		57.0	2.6	
		100		54.4	2.2	
		0	9.72	80.0	24.8	43 Conner.
		14		79.0	17.4	
		25		77.1	13.9	
		50		69.5	8.39	
		75		63.5	5.30	
		80		62.3	4.92	
		90		57.7	3.95	
		100		55.3	3.40	
		0	1.24	14.89	26.3	52 Lane.
		10		21.29	31.6	
		20		29.64	35.2	
		30		37.76	35.8	
		40		44.60	34.2	
		50		48.75	31.1	
		30	1.24			55.1 Srivastava.
		24; 30	0.86			53 Hertel.
		(20)	3.16			53 LeMontagner.
		5 to 45	7.4			52 Yamamura.
		1 to 50	16.7			51.1 51.2 Yasumi.
		11.1	0.87			50 Kiely.
		(20)	3 to 10			46 Abadie.
		20	16.7			44 Benoit.
		20.5; 25.5	320 to 1002			41 Khodakov.
		24	23.6; 450			40.1 Divilkovsky.
		(20)	1.65; 3.7			39 Kebbel.
		18	4			37 Elle.
		21 to 28	8.5 to 23.8			37 Goldsmith.
		(15); 30; 50	12.6 to 19			33 Seeberger.
		17	23 to 73			29 Frankenberger.
		17	220 to 300			29 Novosilzew.
		14 to 20	268			27 Deubner.
		(18)	36 to 321			27 Heim.
		22	4.8 to 20.5			27 Knerr.
3	H_2SO_4 Sulfuric acid	20	∞	(110)		53 Brand.
			303.0	98	32	
			198.0	95	35	
			156.7	77	40	
			101.4	62.5	45.6	
			26.74	28	42	
			10.20	10	19	

TABLE 4. *Dielectric dispersion data for pure organic liquids*

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
	C_1					
1	$CBrCl_3$ Bromotrichloromethane	0	∞	2.447		56.3 Smyth et al.
			3.22	2.441	0.014	
			1.24	2.426	.021	
		20	∞	2.405		
			3.22	2.403	.012	
			1.24	2.389	.020	
		40	∞	2.364		
			3.22	2.361	.0082	
			1.24	2.351	.0018	
		60	∞	2.343		
			3.22	2.319	.0059	
			1.24	2.313	.0016	
2	CBr_2Cl_2 Dibromodichloromethane	25	∞	2.542		56.3 Smyth et al.
			10.0	2.541	<.003	
			3.22	2.540	.0136	
			1.24	2.524	.036	
		40	∞	2.508		
			10.0	2.511	<.003	
			3.22	2.511	.011	
			1.24	2.494	.030	
		60	∞	2.461		
			3.22	2.470	.006	
			1.24	2.455	.020	

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_1—Continued						
3	CBr_2F_2	Dibromodifluoromethane	0	∞	2.824		56.3	Smyth et al.
				3.22	2.769	0.116		
				1.24	2.670	.088		
			20	∞	2.713			
				3.22	2.676	.225		
				1.24	2.592	.193		
4	CBr_3Cl	Tribromochloromethane	60	∞	2.601		56.3	Smyth et al.
				3.22	2.600	.009		
				1.24	2.593	.018		
5	CBr_3F	Tribromofluoromethane	0	∞	3.092		56.3	Smyth et al.
				10.0	3.080	.038		
				3.22	3.001	.213		
				1.24	2.776	.262		
			20	∞	2.996			
				10.0	2.996	.030		
				3.22	2.994	.168		
				1.24	2.778	.241		
			40	∞	2.902			
				10.0	2.913	.022		
				3.22	2.884	.135		
				1.24	2.735	.215		
			60	∞	2.822			
				3.22	2.804	.106		
				1.24	2.698	.194		
6	CCl_3F	Trichlorofluoromethane	0	∞	2.374		56.3	Smyth et al.
				3.22	2.373	.048		
				1.24	2.339	.113		
			20	∞	2.303			
				3.22	2.297	.035		
				1.24	2.270	.081		
7	CCl_4	Carbon tetrachloride	0	∞	2.276		52.2	Smyth et al.
				10.00	2.278			
				1.277	2.278			
			20	∞	2.239			
				10.00	2.240			
				1.277	2.240			
			40	∞	2.203			
				10.00	2.204			
				1.277	2.203			
			60	∞	2.167			
				10.00	2.166			
				1.277	2.165			
			20	3.2	2.238_6	.00069	47	Bleaney.
				1.35	2.239_0	.00175		
			20	0.85 to 3.33	(*)	(*)	50	Whiffen.
			20	10 to ∞			53	MIT.
			20	3.39			55	Takahashi.
			(20?)	3.27			55.2	Srivastava.
8	CS_2	Carbon disulfide	0	∞	2.691		50.2	Smyth et al.
				10.00	2.692			
				1.277	2.695			
			10	∞	2.666			
				10.00	2.667			
				1.277	2.669			
			20	∞	2.641			
				10.00	2.642			
				1.277	2.643			
			30	∞	2.615			
				10.00	2.617			
				1.277	2.617			
			20	3.2	2.647_6	.00064	47	Bleaney.
				1.35	2.647_7	.00191		
			20	0.85 to 3.33	(*)	(*)	50	Whiffen.
			(20?)	3.27			55.2	Srivastava.
9	$CHCl_3$	Chloroform	25	9.72	4.81	$.37_9$	43	Conner.
			25	4.90	4.72	.0088	53	Fischer.
			(?)	3.33			53	Sirkar.
			−60 to 35	3.18			53.2	Ghosh.
10	CH_2O_2	Formic acid	10; 34	60 to 100			51	Sen.

*Graphs.

TABLE 4.—*Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
	C_1—Continued							
11	CH_3NO	Formamide	(20)	501	110.5	2.4	49	Burdun.
				436	107.6	----		
				308	108.0	4.9		
				216	109.0	5.8		
				101	110.0	8.0		
				89.8	108.5	10.8		
				64.5	108.0	15.8		
				41.0	107.0	21.0		
				23.6	93.6	40.8		
				8.4	77.7	44.4		
				5.1	58.0	56.0		
				3.2	37.2	43.0		
				1.6	13.5	34.0		
12	CH_4O	Methanol	−10	∞	40.37		52	Lane.
				3.21	7.20	5.66		
				1.24	6.75	3.76		
				0.62	6.05	2.88		
			0	∞	37.98			
				3.21	7.41	6.52		
				1.24	6.78	4.06		
				0.62	6.03	2.88		
			10	∞	35.75			
				3.21	7.78	7.36		
				1.24	6.81	4.36		
				0.62	6.05	2.98		
			20	∞	33.64			
				3.21	8.33	8.16		
				1.24	6.88	4.74		
				0.62	6.02	3.14		
			30	∞	31.65			
				3.21	9.07	8.92		
				1.24	6.93	5.14		
				0.62	6.03	3.30		
			40	∞	29.29			
				3.21	9.94	9.66		
				1.24	6.97	5.58		
				0.62	6.04	3.47		
			50	∞	28.03			
				3.21	11.08	10.28		
				1.24	7.08	6.00		
				0.62	6.10	3.64		
			20	3.99	9.72	10.20	55	Poley.
				3.51	8.68	9.14		
				3.20	7.78	7.69		
				1.25	5.98	4.48		
				0.802	5.68	3.23		
			25	3.20	8.18	8.00		
				1.25	6.04	4.13		
			−60	5×10^3	48	----------------	[a] 28, 27	Mizushima.
				950	51	7		
				58	13	10		
			−40	5×10^3	43			
				950	45	2		
				308	43	10		
				58	20	11		
			−20	5×10^3	39			
				950	40	1		
				308	40	4		
				58	26	10		
			0	5×10^3	35			
				950	37	1		
				308	37	2		
				58	29	7		
			−143 to 118	10^4 to ∞	(**)(*)	(**)(*)	55	Denney.
			25	∞	32.63		53	MIT.
				300	31.0	1.2		
				100	30.9	2.5		
				10	23.9	15.3		
				3	8.9	7.2		
			18.4	243	34.6	1.55	39	Slevogt.
				58.3	34.3	5.15		
				16.3	22.6	15.4		
			19.5	10.44	17.0	17.4		
			19.0	9.0	15.8	11.0	39	Bäz.
				6.20	7.57	7.90		
				3.80	4.44	5.52		
				2.80	3.50	4.24		

* Graphs. ** Table 2. [a] Data also at 20° and 40° C.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_1—Continued			b (n^2)			
	CH_4O	Methanol (continued)	18	56.0	31.4		36	v. Ardenne.
				53.2	32.4			
				51.5	32.3			
				51.1	32.4			
				49.3	31.8			
				49.0	31.6			
				34.9	29.9			
				34.2	30.0			
				34.0	29.5			
				13.45	22.7			
			20	436		0.790	49	Fischer.
			25			.648		
			30			.545		
			40			.345		
			(20)	83.6	32.2	3.5	55	Yamamura.
			5	3.08	7.25	5.71	53	Koizumi.
			20		8.35	7.20		
			35		9.69	9.37		
			50		10.87	9.48		
			9	1.38	6.79	4.24	55	Okabayashi.
			30	1.24			55.1	Srivastava.
			(15 to 35)	7.4			52	Yamamura.
			25	3.24			52	Yasumi.
			40	1.08×10^3			50	Klages.
			(16 to 18)	18 to 24			39	Divilkovsky.
			(20)	440			39	Fillipov.
			(20)	1.65			39	Kebbel.
			20	147 to 520			39	Maibaum.
			24	2.8×10^3			37	Schmelzer.
			(20)	340 to 1190			37	Zouckermann.
			(20)	$(2.8 \text{ to } 7.6)\times10^3$			32	Malsch.
		C_2						
13	C_2Cl_4	Tetrachloroethylene	20	0.8 to 3.3	(*)	(*)	50	Whiffen.
14	$C_2H_3Cl_3$	1,1,1-Trichlorethane	4	∞	7.71		56.2	Smyth et al.
				3.22	6.981	1.95		
				1.24	4.891	2.70		
			20	∞	7.20			
				10.00	7.242	0.49		
				3.22	6.720	1.52		
				1.24	5.007	2.49		
			40	∞	6.57			
				10.0	6.605	0.37		
				3.22	6.309	1.16		
				1.24	5.165	2.15		
			20	3.20	6.64	1.59	55	Poley.
				1.25	5.20	2.42		
				0.802	4.02	2.44		
			25	9.72	7.02	0.64	43	Conner.
15	$C_2H_4Br_2$	Dibromoethane	25	∞	4.76		52.5	Smyth et al.
				10.0	4.62	.46	52.1	
				3.22	4.02	.95	52.7	
				1.27	3.28	.80	52.4	
			40	∞	4.67			
				10.0	4.61	.37		
				3.22	4.17	.89		
				1.27	3.37	.86		
			55	∞	4.58			
				10.0	4.58	.31		
				3.22	4.23	.77		
				1.27	3.47	.89		
			25 to 70	3.18			53.2	Ghosh.
16	C_2H_4BrCl	1-Bromo-2-chloroethane	−20 to −40	3.18			55	Ghosh.
17	$C_2H_4Cl_2$	1,2-Dichloroethane	1	∞	11.66		52.5	Smyth et al.
				10.0	11.12	1.60	52.1	
				3.22	8.91	3.97	52.7	
				1.27	5.64	3.93	52.4	
			25	∞	10.16			
				10.0	9.98	1.00		
				3.22	9.01	2.79		
				1.27	6.14	3.70		
			40	∞	9.37			
				10.0	9.27	0.75		
				3.22	8.62	2.18		
				1.27	6.49	3.35		
			55	∞	8.66			
				10.0	8.63	0.57		
				3.22	8.24	1.77		
				1.27	6.67	2.96		
				3.3			53	Sircar.
			−25 to 60	3.18			53.2	Ghosh.

*Graphs. b n-refractive index.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References
	C_2—Continued						
18	$C_2H_4O_2$	Acetic acid	20	∞	6.15		52.2 Bruma.
				9	4.72	0.95	
19	C_2H_5Br	Bromoethane	1	∞	10.23		52.5 Smyth et al.
				10.0	10.20	.80	52.1
				3.22	9.50	2.14	52.7
				1.27	7.09	3.46	52.4
			25	∞	9.20		
				10.0	9.24	0.60	
				3.22	8.87	1.54	
				1.27	7.29	2.70	
			25	3			48 Crouch.
20	C_2H_5I	Iodoethane	25	∞	7.69		43 Conner.
				9.72	7.76	0.76	
21	C_2H_6O	Ethanol	−10	∞	30.2		52 Lane.
				3.21	4.55	1.51	
				1.24	4.11	1.23	
				0.62	3.43	0.97	
			0	∞	28.39		
				3.21	4.56	1.69	
				1.24	4.14	1.32	
				0.62	3.43	1.01	
			10	∞	26.68		
				3.21	4.56	1.92	
				1.24	4.21	1.41	
				0.62	3.45	1.05	
			20	∞	25.07		
				3.21	4.54	2.23	
				1.24	4.23	1.55	
				0.62	3.45	1.04	
			30	∞	23.56		
				3.21	4.61	2.68	
				1.24	4.24	1.72	
				0.62	3.47	1.17	
			40	∞	22.14		
				3.21	4.80	3.22	
				1.24	4.27	1.99	
				0.62	3.46	1.25	
			50	∞	20.80		
				3.21	5.10	3.88	
				1.24	4.39	2.28	
				0.62	3.48	1.37	
			−60	∞	41		[e] 28, 27 Mizushima.
				5×10^3	39	4	
				950	24	21	
				308	9	9	
				59	3.1	2	
			−40	∞	35.7		
				5×10^3	32.	3	
				950	33.	9	
				308	17.5	15	
				59	4.0	4	
			−20	∞	31.2		
				950	31	3	
				308	26	13	
				59	6.0	6	
			−143 to −113	6×10^3 to ∞	(**)(*)	(**)(*)	55 Hassion.
			21	3.99	4.84	2.91	55 Poley.
				3.55	4.75	2.77	
				3.20	4.59	2.50	
				1.25	4.13	1.42	
				0.802	3.89	1.30	
			25	∞	24.30		53 MIT.
				300	23.7	1.47	
				100	22.3	6.0	
				10	6.5	1.63	
				3	1.7	0.12	
			18.4	243	26.0	3.29	39 Slevogt.
			19.1	58.3	20.4	9.95	
			20	16.3	9.35	11.5	
			19.8	10.59	5.9	7.3	
			20	10.0	4.67	5.64	39 Bäz.
				6.0	2.98	3.48	
				3.8	2.54	2.64	
				2.8	1.78	1.70	

*Graphs. **Table 2.

[e] Data also at 0°, 20°, 40°, and 60° C.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.		Substance	t (°C)	λ (cm)	ε′	ε″	References	
		C_2—Continued						
21	C_2H_6O	Ethanol—Continued	18	55.5	[n^2] b 22.4		36	v. Ardenne.
				52.6	22.2			
				51.7	21.2			
				48.6	20.8			
				32.1	17.0			
				13.4	8.4			
			20	518		1.237	49	Fischer.
			25			0.995		
			30			.826		
			40			.587		
			50			.411		
			0	182	27.7	9.1	33	Szymanowski.
			10		26.5	6.9		
			20		25.2	4.5		
			30		23.9	2.6		
			40		22.6	1.7		
			50		21.3	1.2		
			20	159	24.8	5.0	39	Sosinski.
			(20?)	83.6	23.0	8.3	55	Yamamura.
			18.5	16.66	7.56	7.2	44	Benoit.
			(20?)	12.60	5.5	7.8	48	Bolton.
			20	9.95		0.966 ($n\kappa$) b	50	Honerjäger.
			25	3.24	4.08	2.58	52	Yasumi.
			5	3.08	4.37	1.93	53	Koizumi.
			20		4.38	2.19		
			35		4.46	2.70		
			50		4.71	3.79		
			8	1.38	4.25	1.42	55	Okabayashi.
			24	0.86	3.6	1.65	53	Hertel.
			30	1.24			55.1	Srivastava.
			5 to 35	7.4			52	Yamamura.
			40	1.08×10^3			50	Klages.
			?	30 to 105			44	Khmel'kova.
			16 to 18	18 to 24			39	Divilkovsky.
			(19 to 20)	440			39	Fillipov.
			20	3×10^3			39	Panchenkov.
			18.7	4			37	Elle.
			20 to 40	5×10^3			37	Hackel.
			21	2.1×10^3			37	Schmelzer.
			(20)	$(2\text{ to }12)\times10^2$			37	Zouckermann.
			(20)	$(2.8\text{ to }7.6)\times10^3$			32	Malsch.
22	$C_2H_6O_2$	Ethylene glycol	25	∞	41.3		53	MIT.
				300	41	1.85		
				100	39	6.2		
				10	12	12.0		
				3	7	5.5		
			10	∞	40.7		53	Yamamura.
				14.16	12.65	12.48		
				7.86	7.06	9.79		
			20	∞	38.7			
				14.16	15.85	11.25		
				7.86	10.33	11.14		
			30	∞	36.7			
				14.16	20.56	10.85		
				7.86	12.59	10.7		
			40	∞	34.9			
				14.16	23.52	12.62		
				7.86	15.35	13.9		
			−20	5×10^3	46.5	2	28	Mizushima.
				718	36.7	16		
				308	29.4	17		
			0	5×10^3	44.3	1		
				718	44.3	4		
				308	42.0	6		
			20	5×10^3	44.3	1		
				718	41.3	2		
				308	41.3	2		
			40	5×10^3	37.7	1		
				718	37.7	2		
				308	37.7	1		
			25	$(1\text{ to }2)\times10^3$			39	Schmale.
		C_3						
23	C_3H_5Cl	3-Chloropropene	−100 to 40	3.18			54.2	Ghosh.
24	$C_3H_6Cl_2$	1,3-Dichloropropane (trimethylene chloride).	25	9.72	10.2	1.34	43	Conner.

b n=refractive index. κ=absorption coefficient.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Formula	Substance	t (°C)	λ (cm)	ε′	ε″	References	
		C_3—Continued						
25		2,2-Dichloropropane	2	∞	12.58		56.2	Smyth et al.
				3.22	10.77	4.05		
				1.24	6.427	5.3		
			20	∞	11.42			
				3.22	10.12	3.10		
				1.24	6.766	4.7		
			40	∞	10.24			
				3.22	9.54	2.27		
				1.24	6.993	4.1		
26	$C_3H_6Cl_2O$	2,3-Dichloro-1-propanol	(20)	(45 to 600)	(*)	(*)	32	Girard.
27		1,3-Dichloro-2-propanol	(20)	(45 to 600)	(*)	(*)	32	Girard.
28	$C_3H_6N_2O_4$	2,2-Dinitropropane	60	∞	35.0		56.2	Smyth et al.
				10.0	33.6	8.0		
				3.22	22.4	15.7 ±2		
			60	3.22	23.3	16.3	53	Powles.
29	C_3H_6O	Acetone	25	∞	20.7		53	Fischer.
				490	----------	0.0334		
			20	∞	21.2		44	Benoit.
				16.66	21.0	.88		
			(20?)	3.16	18.5	3.1	53	LeMontagner.
			20	(3 to 12)	(*)	(*)	46	Ahadie.
			5 to 65	(60 to 120)			51	Sen.
			(20)	18			50	Imanov.
			5 to 63	57 to 100			49	Sirkar.
			25	(1 to 2)×10³			39	Schmale.
			(20)	(2.8 to 7.6)×10³			32	Malsch.
			1	∞	23.29		56.1	Smyth et al.
				10.4	22.95	1.73		
				3.22	21.69	4.39		
				1.24	18.18	8.92		
			20	∞	21.20			
				10.4	21.07	1.32		
				3.22	20.51	3.55		
				1.24	17.75	7.78		
			40	∞	19.29			
				10.4	19.29	1.02		
				3.22	18.58	2.63		
				1.24	16.72	6.15		
30		2-Propen-1-ol-(Allyl alcohol)	−50	5×10³	28.5	1	28	Mizushima.
				781	20.3	13		
				308	10.6	5		
			−30	5×10³	27.3	<1		
				781	26.3	8		
				308	20.3	7		
			−10	5×10³	25.2	<1		
				781	25.2	3		
				308	25.2	3		
			10	5×10³	22.5	<1		
				781	22.5	<2		
				308	22.5	<1		
			30	5×10³	19.4	<1		
				781	19.4	<2		
				308	19.4	<1		
31	$C_3H_6O_2$	Propionic acid	65 to 110	(60 to 120)			51	Sen.
32	$C_3H_6O_3$	1,3,5-Trioxane	65	∞	15.55		56.5	Smyth et al.
				10.4	15.75	2.16		
				3.22	13.11	5.27		
				1.24	8.51	6.80		
			80	∞	14.20			
				10.4	15.04	1.62		
				3.22	12.29	4.36		
				1.24	8.00	5.97		
33	C_3H_7Br	1-Bromopropane	1	∞	8.90		52.5	Smyth et al.
				10.0	8.57	0.93	52.1	
				3.22	7.39	2.53	52.7	
				1.27	5.07	2.86	52.4	
			25	∞	8.09			
				10.0	7.97	0.66		
				3.22	7.18	1.94		
				1.27	5.46	2.53		
			40	∞	7.59			
				10.0	7.48	0.53		
				3.22	7.00	1.63		
				1.27	5.52	2.36		
			55	∞	7.09			
				10.0	7.06	0.44		
				3.22	6.79	1.33		
				1.27	5.52	2.18		

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance	t (°C)	λ (cm)	ε'	ε''	References
	C_3—Continued					
34	2-Bromopropane	1	∞	10.52		52.5 Smyth et al.
			10.0	9.88	1.02	52.1
			3.22	9.26	2.82	52.7
			1.27	6.45	4.08	52.4
		25	∞	9.46		
			10.0	9.33	0.69	
			3.22	8.80	2.05	
			1.27	6.77	3.53	
		40	∞	8.89		
			10.0	8.86	0.55	
			3.22	8.42	1.66	
			1.27	6.81	3.08	
		55	∞	8.14		
			10.0	8.30	0.46	
			3.22	8.02	1.41	
			1.27	6.78	2.70	
35	C_3H_8O 1-Propanol	156 to −120	6×10^3 to 1.5×10^9	(**) (*)	(**) (*)	52 Cole.
		−144 to −45	6×10^3 to 1.5×10^9	(**) (*)	(**) (*)	51 Davidson.
		25	∞	20.1		53 MIT.
			300	19.0	3.8	
			100	16.0	6.7	
			10	3.7	2.5	
			3	2.3	0.21	
		20	∞	20.8		47 Girard.
			324	19.3		
			199	17.4		
			85	11.2		
			62	9.2		
			28.0	5.35		
			17.1	4.5		
			11.1	4.06		
			6.42	3.93		
			3.45	3.62		
			2.94	3.46		
		18 to 20	598	19.0	1.7	37 Abadie.
			330	18.7	3.7	
			200	17.1	5.1	
			188	16.8	5.5	
			113	14.8	7.7	
			97	13.5	7.7	
			86	12.15	7.5	
			75	11.2	8.1	
			61.7	10.05	8.1	
			55	9.01	8.1	
			45	7.2	7.3	
			42.7	7.4	7.4	
			28.1	7.2	5.5	
			28.1	4.7	5.2	
			17.7	4.1	3.8	
			17.5	3.4	3.3	
		−60	5×10^3	24.4	14	28, 27 Mizushima.
			950	7	7	
			380	5	2	
			57.8	3	1	
		−40	5×10^3	30	4	
			950	15	13	
			380	6.5	4	
			57.8	3.1	1	
		−20	5×10^3	27.5	3	
			950	24	8	
			380	11	9	
			57.8	3.1	2	
		0	5×10^3	24	3	
			950	25	3	
			308	17.5	9	
			57.8	3.9	3	
		19	1130	21.1	------------	39 Slevogt.
		18 3	243	20.3	4.83	
		18.8	58.3	9.3	9.4	
		18.5	16.3	5.7	4.65	
		20	10.44	4.5	3.81	
		20	77.67	14.8	8.3	56 Fischer.
			70.91	13.7	8.9	
			60.19	12.2	9.1	
		20	3 to 500	(*)	(*)	42 Abadie.
		(20)	40 to 600	(*)	(*)	32 Girard.
		15 to 35	360 to 660			36 Keutner.
		0	182	12.6	10.6	33 Szymanowski.
		10		15.4	10.1	
		20		17.4	7.5	
		30		17.4	4.5	
		40		16.8	3.0	
		50		16.2	1.8	

*Graphs. **Table 2.

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_3—Continued						
35	C_3H_8O	1-Propanol—Continued	22.7	70.82	14.9	8.1	39	Slätis.
			18	16.66	4.70	3.5	44	Benoit.
			5	3.08	3.42	1.06	53	Koizumi.
			20		3.45	1.30		
			35		3.50	1.72		
			50		3.61	2.36		
			(20?)	30 to 105			44	Khmel'kova.
			16 to 18	18 to 24			39	Divilkovsky.
			23.3	440			39	Fillipov.
			20	159			39	Sosinski.
			−60 to 60	500			37.2	Cavallaro.
			20 to 40	5×10³			37	Hackel.
			19 to 21	2.1×10³			37	Schmelzer.
			25	170 to 10⁵			37	Schreck.
			(20)	(2.8 to 7.6)×10³			32	Malsch.
36		2-Propanol	−100 to −73	6×10³ to ∞	(**)(*)	(**)(*)	55	Hassion.
			−60	5×10³	15.5	14	[d] 27	Mizushima.
				950	6	6		
				308	4	1		
			−40	5×10³	28	8		
				950	13	13		
				308	4.5	2		
			−20	5×10³	28	<3		
				950	24	9		
				308	7.5	6		
			0	5×10³	24	<3		
				950	24	3		
				308	16	9		
			20	5×10³	20.5	<3		
				950	21	1		
				308	19	4		
			(20)	45 to 600	(*)	(*)	32	Girard.
			25	3.24	3.06	1.18	52	Yasumi.
37	$C_3H_8O_2$	1,2-Propanediol	10	∞	(35)		55.2	Yamamura.
				22.78	5.4	5.2		
				15.46	4.2	2.0		
				7.61	4.85	3.08		
			20	∞	(33)			
				49.16	27.72	8.4		
				22.82	6.9	7.4		
				15.18	5.2	4.3		
				7.63	5.32	4.23		
			30	∞	(31)			
				50.02	27.11	6.4		
				22.80	9.3	10.7		
				15.00	7.2	6.0		
				7.62	4.84	4.72		
			40	∞	(29)			
				49.14	25.95	8.4		
				22.83	11.9	10.2		
				15.00	8.7	4.8		
				7.64	6.50	5.0		
			−89 to −45	6×10³ to ∞	(**)(*)	(**)(*)	51	Davidson.
			−90 to −30	3×10⁵ to 3×10⁷	(*)	(*)	32	White.
38		1,3-Propanediol	−95 to −40	3×10⁵ to 3×10⁷	(*)	(*)	32	White.
39	$C_3H_8O_3$	Glycerol	−80 to −40	10³ to 3×10⁷			54	Schulze.
			−75 to −40	6×10³ to ∞	(**)(*)	(**)(*)	51	Davidson.
			0	6×10⁴	48.20	0.99	53	Harris.
				3×10⁴	48.10	2.14		
				2×10⁴	47.86	3.5		
			−10	5×10³	23	17	[e] 28	Mizushima.
				950	12	7		
				308	7	3		
				57.8	3	1		
			10	5×10³	44	6		
				950	34	14		
				308	14	10		
				57.8	4	2		
			30	5×10³	40.5	< 3		
				950	42	5		
				308	38	17		
				57.8	9	7		
			50	950	37	< 3		
				308	40	7		
				57.8	18.7	11		

*Graphs. **Table 2. [d] Data also at 40° and 60° C. [e] Data also at −50° C.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
	C_3—Continued							
					(n^2)			
39	$C_3H_8O_3$	Glycerol—Continued	18	62.0	28.6		36	v. Ardenne.
				55.6	27.1			
				49.5	23.1			
				48.9	23.4			
				34.0	16.4			
				13.45	10.3			
			−30 to 20	(8 to 37.5)×10^2			[f]53	Litovitz.
			31	57 to 84			49	Sirkar.
			25	(3 to 9)×10^3			36	Hiegemann.
			25	(1 to 2)×10^3			36	Schmaks.
			−75 to 19	170 to 10^3			36	Schreck.
			24 to 40	410			35	Divilkovsky.
			15 to 70	12 to 14			33	Seeberger.
			−61 to 64	610			26	Mizushima.
	C_4							
40	C_4Cl_6	Hexachloro-1,3-butadiene	25	∞	2.55		53	MIT.
				100	2.55	0.014		
				10	2.51	.060		
				3	2.47	.032		
41	C_4H_4O	Furan	1	∞	3.095		55.1	Smyth et al.
				3.22	3.088	.129		
				1.24	3.009	.318		
			20	∞	2.954			
				3.22	2.958	.092		
				1.24	2.920	.245		
42	C_4H_4S	Thiophene	1	∞	2.837		55.1	Smyth et al.
				10.7	2.823	.011		
				3.22	2.816	.082		
				1.24	2.370	.176		
			20	∞	2.769			
				10.7	2.764	.013		
				3.22	2.752	.064		
				1.24	2.697	.154		
			40	∞	2.701			
				10.7	2.700	.006		
				3.22	2.697	.051		
				1.24	2.650	.124		
			60	∞	2.635			
				10.7	2.634	.007		
				3.22	2.603	.038		
				1.24	2.582	.090		
43	C_4H_5N	Pyrrole	1	∞	8.42		55.1	Smyth et al.
				10.7	8.370	1.11		
				3.22	6.575	2.33		
				1.24	4.482	2.22		
			25	∞	8.10			
				10.7	8.046	0.87		
				3.22	7.003	2.00		
				1.24	4.829	2.40		
			40	∞	7.76			
				10.7	7.670	0.64		
				3.22	7.055	1.59		
				1.24	5.251	2.53		
			60	∞	7.45			
				10.7	7.362	0.47		
				3.22	6.978	1.24		
				1.24	5.569	2.35		
44	$C_4H_8Cl_2$	1,4-Dichlorobutane	1	∞	9.64		52.5	Smyth et al.
				10.0	9.40	1.84	52.1	
				3.22	6.56	3.42	52.7	
				1.27	4.42	2.48	52.4	
			25	∞	8.90			
				10.0	9.06	1.21		
				3.22	7.09	2.86		
				1.27	4.79	2.73		
			40	∞	8.44			
				10.0	8.70	0.90		
				3.22	7.30	2.45		
				1.27	5.08	2.80		
			55	∞	7.98			
				10.0	7.28	2.00		
				1.27	5.36	2.80		

[f] 95% Glycerol, 5% water.

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
	C_4—Continued					
45	1,2-Dichloroisobutane	−155. 6	6×10[7]	3. 03	0. 90	42 Turkevich.
		−154. 5		3. 21	1. 48	
		−147. 9		6. 54	5. 62	
		−146. 9		7. 84	7. 63	
		−145. 3		12. 00	9. 90	
		−144. 2		14. 63	10. 2	
		−143. 0		18. 17	7. 16	
		−142. 3		20. 24	2. 73	
		−140. 1		19. 79	2. 52	
		−138. 2		19. 75	1. 98	
	(glass)	−131. 5		18. 08	0. 33	
		−126. 7		17. 36	. 17	
	mp	(−108)		14. 85	. 36	
		−63. 1		10. 95	. 87	
		−23. 2		8. 88	1. 36	
		−22. 8		7. 13	4. 06	
		−187. 8	6×10[6]	2. 36	0. 008	
		−156. 4		2. 75	. 164	
		−147. 9		4. 63	1. 44	
		−147. 6		4. 71	1. 37	
		−146. 4		5. 54	2. 78	
		−144. 2		8. 97	4. 64	
		−143. 5		9. 70	5. 4	
		−141. 7		13. 96	6. 0	
		−140. 0		17. 81	5. 03	
		−139. 8		18. 03	4. 1	
		−139. 1		18. 60	2. 54	
		−135. 5		18. 71	1. 19	
		−134. 1		18. 38	0. 62	
		−131. 5		18. 05	. 44	
		−108. 0		14. 87	. 056	
		−99. 0		13. 89	. 041	
		−63. 1		10. 97	. 11	
		−23. 2		8. 87	. 154	
		−22. 8		7. 14	. 416	
		−165. 0	6×10[5]	2. 43	. 085	
		−157. 3		2. 51	. 082	
		−155. 1		2. 66	. 148	
		−147. 9		3. 39	. 60	
		−145. 5		4. 12	1. 22	
		−144. 4		4. 65	1. 69	
		−141. 2		7. 08	3. 67	
		−140. 8		7. 66	4. 05	
		−139. 6		9. 37	4. 90	
		−138. 5		11. 45	5. 44	
		−137. 3		13. 79	5. 42	
		−136. 5		15. 29	4. 97	
		−135. 5		16. 67	3. 9	
		−134. 1		17. 68	2. 72	
		−132. 9		17. 94	1. 79	
		−131. 5		17. 93	1. 09	
		−126. 7		17. 37	0. 292	
		−108. 0		14. 87	. 019	
		−99. 0		13. 88	. 019	
		−63. 1		10. 97	. 023	
		−23. 2		8. 83	. 031	
		−22. 8		7. 15	. 057	
46	C_4H_8O Tetrahydrofuran	1	∞	8. 90		55. 1 Smyth et al.
			3. 22	8. 38	1. 44	
			1. 24	6. 92	2. 95	
		20	∞	8. 20		
			3. 22	7. 87	1. 13	
			1. 24	6. 91	2. 14	
		40	∞	7. 60		
			3. 22	7. 30	0. 81	
			1. 24	6. 67	1. 66	
47	2-Butanone	0 to 65	(60 to 120)			51.2, 49 Sen.
48	$C_4H_8O_2$ Butyric acid	20	9. 0	2. 96	0. 14	52. 2 Bruma.
		67 to 120	(60 to 120)			51. 3 Sen.
49	Ethyl acetate	3	∞	6. 40		52. 8 Smyth et al.
			10. 0	6. 41	0. 42	
			1. 25	4. 91	1. 60	
		20	∞	6. 04		
			10. 0	6. 06	0. 33	
			3. 22	5. 81	. 92	
			1. 25	4. 95	1. 51	
		40	∞	5. 63		
			10. 0	5. 71	0. 24	
			3. 22	5. 53	. 69	
			1. 25	4. 88	1. 31	
		60	∞	5. 22		
			3. 22	5. 21	0. 53	

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_4—Continued						
49		Ethyl acetate—Continued	30	∞	5.94		56	Krishna.
				75.0	6.00	0.04		
				60.0	5.98	.06		
				50.0	5.96	.10		
				42.9	5.93	.11		
				37.5	5.91	.11		
				33.3	5.90	.11		
			−60	37.5	4.24	.22		
			−50		4.54	.40		
			−40		5.10	.82		
			−30		6.78	.59		
			−20		7.09	.38		
			−10		6.88	.25		
			0		6.60	.19		
			10		6.36	.16		
			20		6.12	.13		
			30		5.91	.11		
50	C_4H_9Br	1-Bromobutane	1	∞	7.57		52.5	Smyth et al.
				10.0	7.18	1.15	52.1	
				3.22	5.53	2.26	52.7	
				1.27	4.02	2.00	52.4	
			25	∞	6.93			
				10.0	6.74	0.79		
				3.22	5.70	1.87		
				1.27	4.10	1.97		
			40	∞	6.57			
				10.0	6.44	0.63		
				3.22	5.61	1.60		
				1.27	4.20	1.84		
			55	∞	6.24			
				10.0	6.20	0.51		
				3.22	5.47	1.38		
				1.27	4.29	1.77		
			25	3			48	Crouch.
51		1-Bromo-2-methyl propane	1	∞	7.82		52.5	Smyth et al.
				10.0	7.38	1.07	52.1	
				3.22	6.04	2.47	52.7	
				1.27	4.00	2.40	52.4	
			25	∞	7.18			
				10.0	6.90	0.74		
				3.22	6.01	1.92		
				1.27	4.31	2.32		
			40	∞	6.74			
				10.0	6.60	0.59		
				3.22	5.91	1.61		
				1.27	4.33	2.18		
			55	∞	6.32			
				10.0	6.24	0.46		
				3.22	5.78	1.35		
				1.27	4.40	2.08		
			25	9.72			43	Conner.
52		2-Bromobutane	1	∞	9.43		52.5	Smyth et al.
				10.0	9.52	1.46	52.1	
				3.22	7.59	3.36	52.7	
				1.27	4.83	3.39	52.4	
			25	∞	8.64			
				10.0	8.75	0.98		
				3.22	7.63	2.53		
				1.27	5.27	3.28		
			40	∞	8.15			
				10.0	8.30	0.78		
				3.22	7.45	2.07		
				1.27	5.39	3.03		
			55	∞	7.65			
				10.0	7.90	0.62		
				3.22	7.21	1.76		
				1.27	5.49	2.75		
			25	9.72			43	Conner.
53		2-Bromo-2-methyl propane	1	∞	11.56		52.5	Smyth et al.
				3.22	9.66	3.57	52.7	
				1.27	5.92	4.29	52.4	
			25	∞	10.30			
				3.22	9.04	2.55		
				1.27	6.52	3.95		
			40	∞	9.52			
				3.22	8.75	2.09		
				1.27	6.76	3.52		
			55	∞	8.75			
				3.22	8.21	1.64		
				1.27	6.60	3.14		

TABLE 4.—*Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_4—Continued						
54	C_4H_9Cl	1-Chlorobutane	25	∞	7.24		43	Conner.
				9.72	6.97	0.745		
55		1-Chloro-2-methyl propane	−189.7	6×10^7	2.38	.02	42	Turkevitch.
			−174.6		3.67	1.49		
			−172.2		5.50	4.48		
			−171.8		6.02	5.20		
			−171.1		7.53	6.81		
			−170.6		8.76	7.54		
			−169.2		13.25	8.06		
			−168.0		15.56	5.03		
			−166.4		16.47	1.89		
			−165.7		16.30	1.04		
			−164.9		16.19	0.66		
		(glass)	−162.6		16.00	.14		
		mp	(−138.2)		13.66	.018		
			−108.5		11.28	.018		
			13.9		6.63	.054		
			−189.7	6×10^6	2.37	.024		
			−185.0		2.41	.029		
			−174.0		3.34	.53		
			−171.6		4.28	1.45		
			−170.3		5.39	2.52		
			−168.6		8.00	4.25		
			−167.7		10.55	4.99		
			−166.1		14.37	3.81		
			−165.6		15.24	2.94		
			−164.7		15.89	1.78		
			−163.2		16.09	0.80		
			−162.3		16.04	.330		
			−160.0		15.89	.165		
			−138.2		13.71	.004		
			−108.5		11.29	.011		
			13.9		6.54	.018		
			−189.7	6×10^5	2.35	.02		
			−173.4		2.94	.28		
			−169.8		3.63	.99		
			−167.0		5.40	2.70		
			−165.3		7.73	4.25		
			−164.0		10.67	4.3		
			−161.7		14.84	3.07		
			−159.2		15.73	1.06		
		(glass)	−155.6		15.50	0.193		
			−138.2		13.73	.007		
			−108.5		11.25	.013		
			13.9		6.49	.011		
56		2-Chloro-2-methyl propane	4	∞	10.72		52.2	Smyth et al.
				10.1	11.02	$.90_3$		
				3.22	10.11	2.6		
				1.25	7.04	4.68		
			20	∞	9.87			
				10.1	10.06	0.70_4		
				3.22	9.48	2.0		
				1.25	7.17	4.12		
			40	∞	8.90			
				10.1	9.01	0.53_6		
				3.22	8.82	1.5		
				1.25	7.25	3.41		
			20	∞	9.88		55	Poley.
				3.20	9.34	2.31		
				1.25	7.50	3.64		
				.802	6.07	3.97		
57	C_4H_9I	1-Iodobutane	25	∞	6.12		43	Conner.
				9.72	6.01	1.35		
58	C_4H_9N	Pyrrolidine	1	∞	9.29		55.1	Smyth et al.
				3.22	5.095	2.57		
				1.24	3.777	1.94		
			20	∞	8.30			
				33.3	8.257	(0.57)		
				10.7	7.57	1.40		
				3.22	5.781	2.42		
				1.24	4.131	2.15		
			40	∞	7.36			
				33.3	7.282	(0.26)		
				10.7	7.24	.71		
				3.22	6.118	1.91		
				1.24	4.425	2.04		
			60	∞	6.60			
				33.3	6.627	(0.16)		
				10.7	6.57	.51		
				3.22	6.020	1.35		
				1.24	4.511	1.86		

Table 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_4—Continued						
59	$C_4H_{10}O$	1-Butanol	−139 to −3	1.5×10^4 to ∞	(**)	(**)	55	Dannhauser.
					(*)	(*)	54	Dannhauser.
			25	∞	17.1		53	MIT.
				3×10^4	17.4	0.17		
				3×10^3	17.4	.42		
				300	14.8	4.0		
				100	11.5	6.3		
				10	3.5	1.7		
			19	∞	17.9		39	Slevogt.
			18.3	243	16.0	6.0_3		
			18.8	58.3	6.1	5.5_6		
			18.8	16.3	3.9	2.5_2		
			19.5	10.44	3.34	1.8_2		
			20	77.63	8.0	6.7	56	Fischer.
				60.12	6.3	5.4		
			(20)	45 to 600	(*)	(*)	32	Girard.
			20	9	3.74	1.10	52.2	Bruma.
			25	3.24	3.08	1.08	52	Yasumi.
			5	3.08	3.05	0.67	53	Koizumi.
			20		3.10	.81		
			35		3.19	1.17		
			50		3.29	1.35		
			25	3.00	3.04	0.64	48	Crouch.
			18	1.38	2.93	.57	55	Okabayashi.
			15 to 35	360 to 660			36	Keutner.
			23.9	446			39	Fillipov.
			20	147 to 520			39	Maibaum.
			20	159			39	Sosinski.
			18	(2.6 to 22)$\times10^2$			37	Cavallaro.
			20 to 40	10^4			37	Hackel.
			21	5.6×10^3			37	Schmelzer.
			(20)	(1.85 to 1.22)$\times10^2$			37	Zouckermann.
			17.9	(1.7 to 10)$\times10^4$			36	Schreck.
60		2-Butanol	−121 to −4	1.5×10^4 to ∞	(**) (*)	(**) (*)	55	Dannhauser.
			20	16.66	3.94	2.1	44	Benoit.
			(19?)	1.7×10^4 to 2.7×10^6			36	Schreck.
61		2-Methyl-1-propanol	−137 to 0	1.5×10^4 to ∞	(**) (*)	(**) (*)	55	Dannhauser.
			−50	5×10^3	10	12	28, 27	Mizushima.
				950	4	2		
				308	3	1		
				57.8	2.8	0.4		
			−30	5×10^3	23.5	8		
				950	7	10		
				308	4	1		
				57.8	2.8	0.6		
			−10	5×10^3	23.5	3		
				950	17	19		
				308	7	7		
				57.8	3	2		
			10	5×10^3	21	3		
				950	20	3		
				308	13	7		
				57.8	3.5	3		
			30	950	17	1		
				308	16.5	3		
				57.8	6.7	4		
			50	950	15	1		
				308	15	1		
				57.8	10.5	4		
			20	10 to 10^3	(*)	(*)	46	Häfelin.
			(20)	70 to 600	(*)	(*)	32	Girard.
			0	182	5.4		33	Szymanowski.
			10		8.6	8.45		
			20		11.9	8.40		
			30		13.6	5.56		
			40		13.7	3.54		
			50		13.25	2.14		
			25	3.24	2.94	1.01	52	Yasumi.

*Graphs. **Table 2.

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_4—Continued						
61		2-Methyl-1-propanol—Continued	5	3.08	2.89	0.51	53	Koizumi.
			20		2.97	.73		
			35		3.08	1.00		
			50		3.24	1.25		
			23	1.38	2.86	0.54	55	Okabayashi.
			(20)	(1.7 to 2.7)×10⁴			36	Schreck.
			25	180			34	Malsch.
62		2-Methyl-2-propanol	30	∞	10.9		56.5	Smyth et al.
				10.0	3.55	1.56		
				3.22	2.966	0.670		
				1.25	2.77	.38		
			50	∞	8.49			
				10.0	4.77	-----------		
				3.22	3.327	1.12		
				1.25	2.96	0.65		
			70	∞	6.89			
				10.0	5.67	1.79		
				3.22	3.923	1.54		
				1.25	3.20	0.93		
			[g] 25	7.43	3.09	.66	52	Yamamura.
			35	7.45	3.29	1.48		
			45	7.44	3.04	1.93		
			25	3.24	2.80	0.85	52	Yasumi.
			26	3.08	2.87	.70	53	Koizumi.
			35		3.00	.86		
			50		3.24	1.24		
			26	1.38	2.82	0.45	55	Okabayashi.
63	$C_4H_{10}O$	Ethyl ether	4	∞	4.70		56.6	Smyth et al.
				10.0	4.68	0.151		
				3.22	4.609	.429		
				1.25	4.30	1.03		
			25	∞	4.24			
				10.0	4.239	0.110		
				3.22	4.184	.280		
				1.25	4.01	.705		
			20	∞	4.335		32	Malsch.
			(20?)	7.6×10³		(0)		
				4.8×10³		(0)		
				2.8×10³		0.00168		
			19.7	1.06×10³		.00451	37	Schmelzer.
			17.2	(10)	4.44	.0835	50	Imanov.
			−10 to 28	(60 to 81)			49	Sen.
		C_5						
64	C_5H_5N	Pyridine	1	∞	14.65		55.1	Smyth et al.
				3.22	11.49	4.79		
				1.24	6.740	5.46		
			20	∞	13.55			
				10.7	13.25	1.42		
				3.22	11.62	3.74		
				1.24	7.386	5.24		
			40	∞	12.45			
				10.7	12.32	1.00		
				3.22	11.32	3.53		
				1.24	7.969	5.10		
			60	∞	11.44			
				10.7	11.36	0.78		
				3.22	10.63	2.22		
				1.24	8.333	4.31		
65	$C_5H_{10}O$	3-Pentanone	0 to 82	(60 to 120)			51.1	Sen.
66	$C_5H_{11}Br$	1-Bromopentane	1	∞	6.88		52.5	Smyth et al.
				10.0	6.15	1.10	52.1	
				3.22	4.30	1.72	52.7	
				1.27	3.30	1.39	52.4	
			25	∞	6.31			
				10.0	5.95	0.79		
				3.22	4.53	1.60		
				1.27	3.47	1.45		
			40	∞	6.00			
				10.0	5.77	0.63		
				3.22	4.57	1.49		
				1.27	3.47	1.39		

[g] mp, 25.5° C Timmermans (50).

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_5—Continued						
66	$C_5H_{11}Br$	1-Bromopentane—Continued	55	∞	5.70			
				10.0	5.58	0.51		
				3.22	4.55	1.34		
				1.27	3.59	1.43		
			75	10.0	5.27	0.38		
67		1-Bromo-3-methyl butane	25	∞	5.93		43	Conner.
				9.72	5.84	1.05		
			−150 to 20	3.33×10^3	(*)	(*)	46.1	Schallamach.
68	$C_5H_{11}Cl$	1-Chloro-3-methyl butane	25	∞	5.94		43	Conner.
				9.72	6.07	0.73		
69		2-Chloro-2-methyl butane	25	∞	(9.1)		43	Conner.
				9.72	6.95	.66		
70	$C_5H_{12}O$	1-Pentanol	−60	5×10^3	5.5	5	28, 27	Mizushima.
				950	4	1		
				308	3	0.4		
				57.8	2.6	.2		
			−40	5×10^3	13	11		
				950	5	2		
				308	3	1		
				57.8	2.6	0.3		
			−20	5×10^3	19	3		
				950	10	6		
				308	4	2		
				57.8	2.6	1		
			0	5×10^3	17.5	3		
				950	17	5		
				308	7.5	6		
				57.8	2.7	1		
			20	950	16	1		
				308	13	5		
				57.8	2.8	2		
			40	950	13	1		
				308	13.5	2		
				57.8	5.7	3		
			60	950	11	1		
				308	12	1		
				57.8	9.3	3		
			0	182	3.9	4.58	33	Szymanowski.
			10		6.1	6.11		
			20		8.4	6.84		
			30		10.7	5.46		
			40		11.55	3.60		
			50		11.6	2.13		
			20	16.66	4.03	1.68	44	Benoit.
			(20)	45 to 600	(*)	(*)	32	Girard.
			5	3.08	2.75	0.49	53	Koizumi.
			20		2.83	.64		
			35		2.94	.91		
			50		3.05	1.13		
			15 to 35	360 to 660			36	Keutner.
			16 to 22	320 to 1002			41	Khodakov.
			20	147 to 520			39	Maibaum.
			20	159			39	Sosinski.
71		3-Methyl-1-butanol	−100 to 0.7	750 to ∞	(**)	(**)	54	Reinisch.
72		2-Methyl-2-butanol	(20?)	30 to 105			44	Khmel'kova.
		C_6						
73	$C_6H_4Cl_2$	o-Dichlorobenzene	25.5	18 to 152			49	Fischer.
74	C_6H_5Br	Bromobenzene	1	∞	5.74		52.5	Smyth et al.
				10.0	5.17	1.12	52.1	
				3.22	3.62	1.36	52.7	
				1.27	2.95	0.82	52.4	
			25	∞	5.39			
				10.0	5.08	.76		
				3.22	3.92	1.34		
				1.27	3.08	0.94		
			40	∞	5.18			
				10.0	5.02	.61		
				3.22	4.06	1.26		
				1.27	3.08	0.94		

*Graphs. **Table 2.

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_6—Continued						
74	C_6H_5Br	Bromobenzene—Continued	55	∞	4.96			
				10.0	4.86	0.48		
				3.22	4.16	1.12		
				1.27	3.18	1.05		
			75	10.0	4.71	0.38		
			20	3.99	4.32	1.36	55	Poley.
				3.55	4.16	1.42		
				3.20	4.06	1.40		
				1.25	3.00	0.98		
				0.802	2.82	.71		
			0	32 to 100			53	Ghosh.
			25	3			48	Crouch.
			20	16.7			44	Benoit.
75	C_6H_5Cl	Chlorobenzene	1	∞	6.15		52.5	Smyth et al.
				10.0	5.73	.88	52.1	
				3.22	----------	----------	52.7	
				1.27	3.29	1.27	52.4	
			25	∞	5.63			
				10.0	5.50	0.64		
				3.22	4.64	1.41		
				1.27	3.44	1.35		
			40	∞	5.31			
				10.0	5.26	0.50		
				3.22	4.66	1.21		
				1.27	3.55	1.39		
			55	∞	5.09			
				10.0	5.06	0.39		
				3.22	4.63	1.01		
				1.27	3.63	1.33		
			22	∞	5.67		55	Poley.
				3.99	4.93	1.32		
				3.55	4.79	1.42		
				3.20	4.59	1.49		
				1.25	3.37	1.39		
				0.802	2.96	1.06		
			20	78.01	5.66	0.108	56	Fischer.
				70.64	5.69	.152		
				60.45	5.72	.158		
			25	450	5.61	0.0149_3	53	Fischer.
			25	3	4.83	1.64	48	Crouch.
			25	32 to 100			53	Ghosh.
			−30 to 0	57 to 120			50	Sen.
			20 to 50	536			49	Fischer.
			25	$(1 \text{ to } 2)\times10^3$			39	Schmale.
			(20)	$(2.8 \text{ to } 7.6)\times10^3$			32	Malsch.
76	C_6H_5ClO	*p*-Chlorophenol		3.18			56	Ghosh.
77	C_6H_5F	Fluorobenzene	21	∞	5.44[h]		55	Poley.
				3.99	5.22	0.71		
				3.20	5.09	.95		
				1.25	4.15	1.54		
				0.802	3.43	1.48		
78	C_6H_5I	Iodobenzene	21	∞	4.64		55	Poley.
				3.99	3.44	0.92		
				3.20	3.31	.875		
				1.25	2.88	.47		
				0.802	2.80	.36		
79	$C_6H_5NO_2$	Nitrobenzene	25	∞	34.82		56	Clark.
				46.2	32.5	4.5		
				37.5	32.1	5.6		
				30.0	31.8	7.44		
				27.3	30.7	9.0		
				14.3	25.7	11.1		
				10.0	20.6	12.65		
			15	10.0	19.8	14.1		
			20		21.4	12.9		
			25		20.6	12.7		
			30		22.6	12.0		
			40		21.4	11.6		
			50		23.9	11.2		
			20	∞	35.73		55	Poley.
				3.99	10.15	12.36		
				3.55	8.53	10.91		
				3.20	7.45	9.51		
				1.25	4.73	4.58		
				0.802	4.05	3.26		
			25	∞	34.82		53	MIT.
				3×10^3	34.4	0.31		
				10	31.1	5.2		

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No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
	C_6—Continued					
79	$C_6H_5NO_2$ Nitrobenzene—Continued	20	78.09	35.9	5.3	56 Fischer.
			70.58	36.2	5.3	
			60.86	35.1	5.9	
		17	3 to 200	(*)	(*)	46, 43 Girard.
				(n^2) [b]		
		18	∞	36.4		36 v. Ardenne.
			72	34.0		
			54.0	33.5		
			32.3	31.5		
			13.45	26.5		
		20	441		0.553	49 Fischer.
		25			.491	
		30			.437	
		40			.339	
		50			.262	
		20	182	34.2	1.96	33 Szymanowski.
		30		32.3	1.40	
		40		30.8	1.07	
		50		29.6	0.82	
		60		26.58	.71	
		(17)	3.16	8.1	6.4	53 LeMontagner.
		25 to 42	532			53 Fischer.
		14	58 to 76			50 Choudhury.
		10 to 60	10			50 Heston.
		26.7	57 to 120			50 Sen.
		20.5	320 to 1002			41 Khodakov.
		16	3×10^3			39 Panchenkov.
		25	$(1 \text{ to } 2)\times10^3$			39 Schmale.
80	C_6H_6 Benzene	20	∞	2.2836	[tan δ]	55 Hartshorn.
			3.33	2.2841	[i] 0.0005	
					.0004	
			1.2		[i] .0009	
					.0009	
		20	3.2	[i] 2.2850	[i] .00057	47 Bleaney.
				2.2835	.00050	
				2.2780	.00035	
			1.35	[i] 2.2853	[i] .0017	
				2.2828	.0012	
				2.2778	.00087	
		20	1.27	2.284	.0011	50 Heston.
		1 to 60	1 to 10			
		20	0.85 to 3.33	(*)	(*)	50 Whiffen.
		(20)	3 to 17			46 Abadie.
		20	3.39			55 Takahashi.
		(20?)	3.27			55.2 Srivastava.
81	C_6H_6O Phenol	40 to 120	3.18			55 Ghosh.
82	C_6H_7N Aniline	20	∞	6.89		49 Fisher.
		20	603		0.0276_6	
		25			$.0243_8$	
		30			$.0213_2$	
		40			$.0166_2$	
		50			$.0127_8$	
		25	460		.0500	53 Fischer.
		42			.0343	
		14	58 to 77			50 Choudhury.
83	γ-Picoline	1	∞	(13.1)		55.1 Smyth et al.
			33.3	12.86	1.00	
		20	∞	(12.2)		
			33.3	12.06	0.71	
			10.7	11.59	2.16	
			3.22	8.165	4.14	
			1.24	4.355	3.72	
		40	∞	(11.3)		
			33.3	11.30	0.55	
			10.7	10.93	1.67	
			3.22	8.726	3.68	
			1.24	4.715	4.05	
		60	∞	(10.5)		
			33.3	10.57	0.40	
			10.7	10.29	1.21	
			3.22	8.893	3.04	
			1.24	5.432	4.36	

*Graphs. [b] n=refractive index. [i] Different samples.

TABLE 4.—*Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_6—Continued						
84	$C_6H_{10}O$	Cyclohexanone	1	∞	17.01		56.1	Smyth et al.
				3.22	10.76	6.39		
				1.24	5.55	5.06		
			20	∞	16.00			
				3.22	11.67	5.72		
				1.24	6.84	5.28		
			40	∞	14.99			
				10.4	14.1	2.1		
				3.22	11.92	4.65		
				1.24	7.33	5.26		
			60	∞	13.99			
				10.4	13.4	2.0		
				3.22	11.81	3.65		
				1.24	7.94	5.16		
			21	14 to 67			56	Dieringer.
85	$C_6H_{11}Br$	Bromocyclohexane	1	∞	8.54		52.5	Smyth et al.
				10.0	7.57	2.24	52.1	
			25	∞	7.92			
				10.0	7.42	1.70		
			40	∞	7.55			
				10.0	7.24	1.42		
			55	∞	7.18			
				10.0	7.02	1.16		
			75	10.0	6.68	0.91		
			21	14 to 67			56	Dieringer.
86	$C_6H_{11}Cl$	Chlorocyclohexane	21	14 to 67			56	Dieringer.
87	$C_6H_{11}NO_2$	Nitrocyclohexane	21	14 to 67			56	Dieringer.
88	C_6H_{12}	Cyclohexane	20	∞	2.0250	[tan δ]	55	Hartshorn.
				3.33		0.0002		
				1.20		.0002		
			20	3.2	2.0244	.00005	47	Bleaney.
				1.35	2.0248	.00019		
			20	0.85 to 3.33	(*)	(*)	50	Whiffen.
89	$C_6H_{12}O$	Cyclohexanol	25	6×10^4	16.8	0.15	56	Arnoult.
				3×10^4	16.8	.18		
				1.5×10^3	16.8	.45		
				8.5×10^3	16.8	.70		
				5.0×10^3	16.7	1.08		
				3.0×10^3	16.1	1.75		
				1.88×10^3	15.94	2.61		
				909	14.50	4.8		
				625	12.2	6.2		
				417	10.0	6.4		
				313	8.0	6.1		
				185	5.73	4.12		
				113	4.65	2.55		
				60.4	4.42	2.20		
				42.9	4.10	1.67		
				21.6	3.77	0.96		
				9.09	3.31	.63		
				3.20	3.04	.38		
			45	3×10^4	15.3	.09		
				5.0×10^3	15.3	.40		
				3.0×10^3	15.3	.86		
				1.88×10^3	15.3	.97		
				909	15.3	1.94		
				625	15.0	2.2		
				417	14.8	2.85		
				313	13.0	4.8		
				185	10.55	5.5		
				113	8.7	5.2		
				60.4	5.97	4.35		
				42.9	5.0	2.92		
				21.6	4.16	1.75		
				9.09	3.57	1.01		
				3.20	3.26	0.54		
			−25 to 49	3×10^2 to 3×10^4	(**) (*)	(**) (*)	53	Reinisch.
			60 to 140	3.18			55	Ghosh.
90	$C_6H_{12}O_3$	Paraldehyde	20	∞	14.70		56.5	Smyth et al.
				10.4	5.14	4.78		
				3.22	2.87	2.08		
				1.24	2.43	1.00		

*Graphs. **Table 2.

Table 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_6—Continued						
90	$C_6H_{12}O_3$	Paraldehyde—Continued	40	∞	12.25			
				10.4	6.54	4.24		
				3.22	3.21	2.26		
				1.24	2.42	1.09		
			60	∞	10.30			
				10.4	7.26	3.36		
				3.22	3.74	2.56		
				1.24	2.53	1.15		
91	$C_6H_{13}Br$	1-Bromohexane	1	∞	6.30		52.5	Smyth et al.
				10.0	----------	----------	52.1	
				3.22	3.75	1.37	52.7	
				1.27	2.96	1.07	52.4	
			25	∞	5.82			
				10.0	5.20	0.91		
				3.22	4.03	1.38		
				1.27	3.11	1.15		
			40	∞	15.56			
				10.0	5.17	0.75		
				3.22	4.14	1.34		
				1.27	3.18	1.17		
			55	∞	5.30			
				10.0	5.14	0.61		
				3.22	4.15	1.21		
				1.27	3.26	1.17		
92	C_6H_{14}	1-Hexane	20	∞	1.890	[tan δ]	47	Bleaney.
				3.2	1.902	0.00034		
				1.35	1.902	.00076		
93	$C_6H_{14}O$	1-Hexanol	−40 to 0.7	750 to ∞	(**) (*)	(**) (*)	54	Reinisch.
			−50 to 60	9	(*)	(*)	54	Brot.
			20	9.0	3.17 (**)	0.70 (**)	52.2	Bruma.
			−50 to 25	3.22	(*)	(*)	53	Brot.
			−50 to 50	1.25	(*)	(*)	55	Brot.
			15 to 35	360 to 660			36	Keutner.
94	$C_6H_{14}O_2$	2-Methyl-2-4-pentanediol	−70 to −20	3×10^5 to 3×10^7	(*)	(*)	32	White.
95	$C_6H_{14}O_6$	Sorbitol	80	40 to 3×10^3			34	Girard.
96	$C_6H_{18}OSi_2$	Hexamethyl disiloxane	−60	∞	2.422		55.2	Smyth et al.
				3.22	2.404	0.0200		
				1.24	2.368	.0430		
			−40	∞	2.353			
				3.22	2.343	(.0152)		
				1.24	2.324	(.0274)		
			−20	∞	2.290			
				3.22	2.285	.0111		
				1.24	2.279	.0205		
			2	∞	2.227			
				10.22	2.221	.0006		
				3.22	2.224	.0075		
				1.24	2.220	.0154		
			20	∞	2.179			
				10.22	2.178	.0004		
				6.17	2.180	.0014		
				3.22	2.179	.0050		
				1.24	2.178	.0123		
			40	∞	2.130			
				10.22	2.130	.0003		
				3.22	2.130	.0031		
				1.24	2.132	.0091		
		C_7						
97	C_7H_5N	Benzonitrile	21	∞	25.57		55	Poley.
				3.99	9.39	9.65		
				3.20	7.17	7.98		
				1.25	4.64	4.29		
				0.802	3.99	3.07		
			20	∞	25.63		49	Fischer.
			20	514		0.2348		
			25			.2060		
			30			.1855		
			40			.1465		
			50			.1201		
98	C_7H_7Cl	Benzyl chloride	−20 to 120	3 to 100			54	Ghosh.

*Graphs. **Table 2.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_7—Continued						
99	C_7H_8	Toluene				[tan δ]		
			−80	1.27		0.0147	46	Whiffen.
			−60			.0196		
			−40			.0236		
			−20			.0265		
			0			.0265		
			20			.0251		
			40			.0230		
			60			.0200		
			80			.0178		
			(19?)	10	2.41	.0205	46	Dunsmuir.
			18.1	(10)			50	Imanov.
			−95 to 27	57 to 120			50	Sen.
			18	16.66			44	Benoit.
			(20?)	3.27	2.41	.053	55.2	Srivastava.
100	C_7H_8O	Benzyl alcohol	−20	5×10³	15.1	2	28	Mizushima.
				718	11.1	6		
				308	8.4	3		
			0	5×10³	19.9	1		
				718	14.8	2		
				308	13.8	2		
			20	5×10³	13.0	0.6		
				718	13.0	.9		
				308	13.0	.5		
			40	5×10³	11.1	.6		
				718	11.0	.9		
				308	11.0	.4		
			20	77.78	10.9	4.8	56	Fischer.
				70.68	10.4	4.9		
				59.98	9.9	4.9		
			19	3 to 200	(*)	(*)	43	Girard.
			5 to 30	35 to 120			54	Ghosh.
			5 to 80	9.4×10³				
101		Methoxybenzene (anisole)	25	∞	4.33		53	Fischer.
				457	4.36	0.00793		
			42		4.20	.00580		
102		*o*-Cresol	18 to 84	34 to 44			52	Kastha.
			30 to 100	3.18			54.2	Ghosh.
103		*m*-Cresol	18 to 84	34 to 44			52	Kastha.
			20 to 120	3.18			54.2	Ghosh.
104		*p*-Cresol	16 to 87	34 to 44			52	Kastha.
			40 to 120	3.18			56	Ghosh.
105	$C_7H_8O_2$	*o*-Methoxyphenol	40 to 140	3.18			56	Ghosh.
106	C_7H_9N	*m*-Toluidine	18	∞	5.95		49	Fischer.
			20	584		.04130		
			25			.03500		
			30			.02996		
			40			.02200		
			50			.01711		
107		Benzylamine	−40 to 100	3 to 125			54.1	Ghosh.
108	$C_7H_{14}O$	2-Heptanone	4	∞	12.86		56.6	Smyth et al.
				10.0	12.26	2.80		
				3.22	--------	----------		
				1.25	--------	----------		
			25	∞	11.68			
				10.0	11.55	1.84		
				3.22	8.939	4.00		
				1.25	4.86	4.00		
			50	∞	10.41			
				10.0	10.40	1.20		
				3.22	9.069	3.00		
				1.25	5.78	3.99		
			70	∞	9.49			
				10.0	--------	----------		
				3.22	--------	----------		
				1.25	6.17	3.50		
			75	∞	9.28			
				10.0	9.37	0.77		
				3.22	8.686	2.15		
				1.25	--------	----------		
			1	∞	13.01		56.1	Smyth et al.
				10.4	12.00	2.7		
				3.22	7.76	4.42		
				1.24	4.58	3.86		

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_7—Continued						
108	$C_7H_{14}O$	2-Heptanone—Continued	20	∞	11.98			
				10.4	11.22	2.2		
				3.22	8.74	4.15		
				1.24	5.03	4.12		
			40	∞	11.02			
				10.4	10.44	(0.90)		
				3.22	8.93	3.40		
				1.24	5.67	4.07		
			60	∞	10.18			
				10.4	9.84	0.91		
				3.22	9.00	2.56		
				1.24	6.3	3.82		
109		4-Heptanone	1	∞	13.82		56.1	Smyth et al.
				10.4	(11.43)	(3.62)		
				3.22	7.91	5.10		
				1.24	4.31	3.9		
			20	∞	12.67			
				10.4	12.00	2.2		
				3.22	8.58	4.61		
				1.24	4.83	4.3		
			40	∞	11.61			
				10.4	11.06	1.6		
				3.22	9.25	3.67		
				1.24	5.54	4.07		
			60	∞	10.71			
				10.4	(9.82)	(0.92)		
				3.22	9.00	2.91		
				1.24	6.05	3.75		
			30 to 85	(60 to 120)			51.1	Sen.
110		5-Methyl-3-hexanone	30 to 95	(60 to 120)			51.1	Sen.
111	$C_7H_{14}O_2$	Isoamyl acetate	20	∞	4.72		52.8	Smyth et al.
				10.0	4.61	0.42		
				3.22	4.10	.87		
				1.25	3.35	1.04		
			50	∞	4.34			
				10.0	4.33	0.27		
				3.22	4.82	.64		
				1.25	3.41	.88		
112	$C_7H_{15}Br$	1-Bromoheptane	1	∞	5.74		52.5	Smyth et al.
				10.0	4.57	1.06	52.1	
				3.22	3.37	1.17	52.7	
				1.27	2.78	0.77	52.4	
			25	∞	5.33			
				10.0	4.53	.86		
				3.22	3.56	1.11		
				1.27	2.89	0.87		
			40	∞	5.11			
				10.0	4.50	.75		
				3.22	3.68	1.08		
				1.27	2.99	0.91		
			55	∞	4.90			
				10.0	4.47	.67		
				3.22	3.71	1.01		
				1.27	3.03	0.95		
			75	∞	(7.26)			
				10.0	4.42	.51		
113	C_7H_{16}	1-Heptane	20	∞	1.924	[tan δ]	47	Bleaney.
				3.2	1.9220	0.00037		
				1.35	1.9223	.00076		
			20	1.27	1.920	.00060	50	Heston.
114	$C_7H_{16}O$	1-Heptanol	0	3.8×10^4	14.0	.31	55.1	Lebrun.
				2.7×10^4	14.0	.34		
				7.5×10^3	13.90	.87		
				3.8×10^3	13.55	2.16		
				2.1×10^3	12.65	3.33		
				1.43×10^3	11.54	4.35		
				1.07×10^3	10.5	------------		
				860	9.43	------------		
				749	8.77	5.17		
				374.5	5.26	4.00		
				249.7	4.50	3.07		
				187.3	3.78	2.43		
				122.0	3.52	1.80		
				59.1	3.36	1.13		
				44.08	3.26	1.04		
				21.66	2.94	0.55		
				9.51	2.85	.40		
				3.19	2.46	.211		

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_7—Continued						
114	$C_7H_{16}O$	1-Heptanol—Continued	20	3×10^4	11.70		55	Lebrun.
				2.38×10^3	11.6	0.94		
				1.5×10^3	11.45	1.64		
				810	10.9	2.70		
				650	10.43	3.10		
				553	10.0	3.48		
				431	9.2	4.		
				313	7.86	4.86		
				231.7	7.05	4.22		
				188	6.09	4.13		
				153	5.25	3.71		
				104	4.19	2.94		
				78.7	3.85	2.53		
				60.15	3.49	1.94		
				43.8	3.44	1.70		
				21.6	3.12	1.09		
				17.23	3.09	0.88		
				9.46	2.99	.66		
				3.17	2.62	.36		
			−34 to 50	7.5×10^2 to 3.8×10^8	(*)	(*)	51	Oppenheim.
			20	9.	2.98	0.55	52.2	Bruma.
			−35 to 60	9.0	(*)	(*)	54	Brot.
			−35 to 25	3.22	(*)	(*)	53	Brot.
			−50 to 50	1.25	(*)	(*)	55	Brot.
		C_8						
115	C_8H_8O	Acetophenone	20	∞	18.66		56.1	Smyth et al.
				10.4	(12.8)	(6.1)		
				3.22	5.62	3.5		
				1.24	3.63	2.2		
			40	∞	17.77			
				10.4	13.0	5.0		
				3.22	6.67	4.2		
				1.24	4.11	2.8		
			60	∞	16.88			
				10.4	13.0	5.9		
				3.22	7.66	4.4		
				1.24	4.35	3.3		
			25 to 42	490			53.2	Fischer.
						[tan δ]		
116	C_8H_{10}	*o*-Xylene	−25	1.27		0.052	46	Whiffen.
			−20			.054		
			0			.057		
			20			.058		
			40			.057		
			60			.059		
			80			.049		
			100			.044		
			120			.040		
			140			.035		
			−20 to 0	30 to 120			53.1	Ghosh.
117		*m*-Xylene	−30	30 to 120			53.1	Ghosh.
118		Ethyl benzene	−95 to 27	60 to 120			50	Sen.
119	$C_8H_{11}N$	2,4,6-Trimethyl pyridine (γ-Collidine).	20	∞	8.00		56.5	Smyth et al.
				10.4	6.15	2.07		
				3.22	3.37	1.67		
				1.24	2.71	0.77		
			40	∞	7.46			
				10.4	6.06	1.71		
				3.22	3.75	1.80		
				1.24	2.75	0.95		
			60	∞	6.94			
				10.4	5.95	1.40		
				3.22	4.09	1.90		
				1.24	2.85	1.03		
120	$C_8H_{16}O_2$	Octanoic acid (Caprylic acid)	20	∞	2.45		52.2	Bruma.
				9.	2.44	0.05		
121	$C_8H_{17}Br$	1-Bromooctane	1	∞	5.32		52.5	Smyth et al.
				10.0	4.10	.97	52.1	
				3.22	3.10	.93	52.7	
				1.27	2.74	.57	52.4	
			25	∞	5.00			
				10.0	4.14	.84		
				3.22	3.28	.90		
				1.27	2.79	.69		
			40	∞	4.80			
				10.0	4.17	.75		
				3.22	3.41	.90		
				1.27	2.810	.73		

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References
		C_8—Continued					
121	$C_8H_{17}Br$	1-Bromooctane—Continued	55	∞	4.60		
				10.0	4.18	0.67	
				3.22	3.48	.87	
				1.27	2.92	.75	
122	$C_8H_{17}Cl$	1-Chlorooctane	1	∞	5.47		52.5 Smyth et al.
				10.0	4.35	.90	52.1
				3.22	3.22	1.09	52.7
				1.27	2.76	0.74	52.4
			25	∞	5.05		
				10.0	4.43	.68	
				3.22	3.50	1.04	
				1.27	2.89	0.86	
			40	∞	4.80		
				10.0	4.40	.59	
				3.22	3.61	.96	
				1.27	2.95	.87	
			55	∞	4.55		
				10.0	4.32	.52	
				3.22	3.63	.86	
				1.27	3.01	.88	
			75	10.0	4.22	.41	
			24.5	8 to 150			42 Klages.
123	$C_8H_{17}I$	1-Iodooctane	1	∞	4.90		52.5 Smyth et al.
				3.22	2.78	.64	52.7
				1.27	2.54	.35	52.4
			25	∞	4.62		
				3.22	2.97	.72	
				1.27	2.59	.44	
			40	∞	4.44		
				3.22	3.03	.72	
				1.27	2.62	.49	
			55	∞	4.27		
				3.22	3.07	.70	
				1.27	2.65	.52	
124	$C_8H_{17}DO$	1-Octanol-D-1	−15 to 50	750	(*)	(*)	52 Corval.
				1.8×10^8			
125	$C_8H_{18}O$	1-Octanol	0	3.8×10^4	12.2	.27	55.1 Lebrun.
				2.7×10^4	12.1	.38	
				7.5×10^3	12.10	.89	
				3.8×10^3	11.6	2.10	
				2.1×10^3	10.70	3.25	
				1.43×10^3	9.34	4.01	
				1.07×10^3	8.33		
				860	7.31	4.30	
				749	6.12	4.24	
				374.5	4.41	2.96	
				249.7	3.69	2.14	
				187.3	3.54	1.90	
				122.0	3.27	1.26	
				59.1	3.07	0.83	
				44.08	2.99	.72	
				21.66	2.78	.434	
				9.51	2.64	.34	
				3.19	2.40	.167	
			20	3×10^4	10.35		55.2 Lebrun.
				2.38×10^3	10.25	.94	
				1.50×10^3	10.05	1.44	
				810	9.41	2.64	
				650	8.90	2.97	
				553	8.26	3.24	
				431	7.6	3.6	
				313	6.45	3.70	
				231.7	5.61	3.64	
				188	5.13	3.28	
				153	4.49	2.80	
				104	3.77	2.24	
				78.7	3.54	1.89	
				60.15	3.30	1.40	
				43.8	3.14	1.27	
				21.6	2.99	0.76	
				17.23	2.85	.68	
				9.46	2.87	.52	
				3.17	2.52	.28	
			2.5	12.5	2.683	.382	56.5 Smyth et al.
				9.04	2.644	.324	
			6	1.25	2.38	.135	
			25	12.5	2.841	.603	
				9.04	2.736	.513	
				3.22	2.584	.323	
				1.25	2.56	.22	

*Graphs.

Table 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_8—Continued						
125	$C_8H_{18}O$	1-Octanol—Continued	50	12.5	3.172	1.02		
				9.04	2.976	0.855		
				3.22	2.662	.496		
				1.25	2.65	.56		
			87	1.25	2.76	.56		
			20	9.	2.84	.43	52.2	Bruma.
			−15 to 49	750 to 3.7×10³	(*)	(*)	53	Dalbert.
			20	3 to 2×10³	(*)	(*)	42	Girard.
			−20 to 60	9.0	(*)	(*)	54	Brot.
			−50 to 50	1.25	(*)	(*)	55	Brot.
			−6 to 20	3×10⁴ to ∞			52	Hamon.
			40	1.08×10³			50	Klages.
			(?)	30 to 105			44	Khmel'kova.
			25	9.72			43	Conner.
			−14 to 24	6×10⁵ to 6×10⁷			36	Smyth.
126		2-Octanol	−36 to 49		(*)	(*)	53	Dalbert.
			−60 to 60	2.6×10³			37	Cavallaro.
			25	9.72			43	Conner.
127		Butyl ether	−130 to 20	1.5×10³	(*)	(*)	46	Schallamach.
		C_9						
128	C_9H_7N	Quinoline	1	∞	9.70		55.1	Smyth et al.
				33.3	9.325	2.19		
				3.22	3.532	1.42		
				1.24	3.227	0.75		
			20	∞	9.03			
				33.3	8.896	1.27		
				3.22	3.904	1.93		
				1.24	3.226	1.04		
			40	∞	8.40			
				33.3	8.473	0.86		
				3.22	4.398	2.27		
				1.24	3.276	1.29		
			60	∞	7.81			
				33.3	8.082	0.64		
				3.22	4.898	2.32		
				1.24	3.441	1.63		
129		Isoquinoline	25	∞	10.43		55.1	Smyth et al.
				33.3	9.834	2.16		
				3.22	3.821	1.85		
				1.24	3.242	1.00		
			40	∞	9.88			
				33.3	9.714	1.65		
				3.22	4.038	2.20		
				1.24	3.267	1.20		
			60	∞	9.22			
				33.3	9.307	1.10		
				3.22	4.563	2.53		
				1.24	3.339	1.55		
130	$C_9H_{19}Br$	1-Bromononane	1	∞	5.01		52.5	Smyth et al.
				10.0	3.77	0.92	52.1	
				3.22	2.84	.76	52.7	
				1.27	2.57	.46	52.4	
			25	∞	4.74			
				10.0	3.86	.81		
				3.22	3.05	.82		
				1.27	2.66	.57		
			40	∞	4.57			
				10.0	3.91	.73		
				3.22	3.17	.83		
				1.27	2.73	.63		
			55	∞	4.40			
				10.0	3.93	.65		
				3.22	3.16	.76		
				1.27	2.77	.66		
131	$C_9H_{20}O$	1-Nonanol	0	3.8×10⁴	11.	.30	55.1	Lebrun.
				2.7×10⁴	11.	.42		
				7.5×10³	10.85	.96		
				3.8×10³	10.10	2.25		
				2.1×10³	8.75	3.25		
				1.43×10³	7.40	3.63		
				1.07×10³	6.60	3.70		
				860	5.70	3.37		
				749	5.55	3.36		
				374.5	3.84	2.21		
				249.7	3.57	1.65		
				187.3	3.23	1.27		
				122.0	3.14	0.96		
				59.1	3.04	.75		
				44.08	2.92	.61		
				21.66	2.70	.37		
				9.51	2.60	.23		
				3.19	2.36	.14		

*Graphs.

Table 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_9—Continued						
131	$C_9H_{20}O$	1-Nonanol—Continued	20	3×10^4	9.05		55	Lebrun.
				2.38×10^3	8.85	0.94		
				1.50×10^3	8.68	1.47		
				810	8.04	2.30		
				650	7.53	2.67		
				553	7.04	2.86		
				431	6.22	2.95		
				313	5.55	3.02		
				231.7	4.89	2.90		
				188	4.37	2.54		
				153	3.96	2.15		
				104	3.55	1.86		
				78.7	3.38	1.48		
				60.15	3.17	1.13		
				43.8	3.12	0.99		
				21.6	2.90	.60		
				17.23	2.81	.56		
				9.46	2.72	.46		
				3.17	2.47	.25		
			−5 to 60	9.0	(*)	(*)	54	Brot.
			−5 to 20	3.22	(*)	(*)	53	Brot.
			−50 to 50	1.25	(*)	(*)	55	Brot.
		C_{10}						
132	$C_{10}H_7Br$	1-Bromonaphthalene	1	3.22	2.99	0.36	52.7	Smyth et al.
			25	∞	4.83		52.5	
				10.0	3.76	.81	52.1	
				3.22	3.02	.51	52.7	
				1.27	2.89	.21	52.4	
			40	∞	4.70			
				10.0	3.90	.77		
				3.22	3.07	.59		
				1.27	2.87	.25		
			55	∞	4.57			
				10.0	4.00	.71		
				3.22	3.12	.66		
				1.27	2.87	.31		
			75	10.0	4.04	.56		
			20	78.05	4.78	4.27	56	Fischer.
				70.48	4.76	4.46		
				60.18	4.70	4.76		
					[n] [b]		51	Meckbach.
			20.5	54.88	2.177			
				52.92	2.178			
				5.90	1.825			
				5.74	1.827			
			20.5	1.3 to 80	(*)	(*)		
			20	529		0.0835	49	Fischer.
			25			.0738		
			30			.0661		
			40			.0521		
			50			.0423		
133	$C_{10}H_7Cl$	1-Chloronaphthalene	1	∞	5.30		52.5	Smyth et al.
				10.0	3.97	1.06	52.1	
				3.22	3.16	0.49	52.7	
				1.27	2.83	.19	52.4	
			25	∞	5.04			
				10.0	4.16	.86		
				3.22	3.08	.63		
				1.27	2.80	.28		
			40	∞	4.88			
				10.0	4.22	.75		
				3.22	3.13	.70		
				1.27	2.80	.33		
			55	∞	4.72			
				10.0	4.29	.64		
				3.22	3.24	.76		
				1.27	2.83	.37		
			75	10.0	4.35	.52		
			20	77.63	4.87	2.92	56	Fischer.
				70.52	4.86	2.93		
				60.22	4.85	3.62		
134	$C_{10}H_{12}O_2$	Eugenol	20	78.23	6.7	3.2	56	Fischer.
				70.61	6.3	3.1		
				60.90	6.0	3.5		
						[(tan δ)/c] [j]		
135	$C_{10}H_{14}$	1-Methyl-4-isopropyl benzene (p-cymene)	−70	1.27		0.0049	46	Whiffen.
			−50			.0067		
			−30			.0080		
			−10			.0087		
			10			.0090		
			30			.0089		
			50			.0085		
			70			.0081		
			100			.0073		
			150			.0061		

*Graphs. [b] n = refractive index. [j] [(tan δ)/c] = specific loss tangent; c = moles/100 ml.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References	
		C_{10}—Continued						
136	$C_{10}H_{16}O$	Citral	−150 to 20	3.33×10^3	(*)	(*)	46.1	Schallamach.
137	$C_{10}H_{16}O_2$	Geranic acid	−140 to 20	9.23×10^3	(*)	(*)	46.1	Schallamach.
138	$C_{10}H_{18}$	*trans*-Decahydronaphthalene	20	0.85 to 3.33	(*)	(*)	50	Whiffen.
139	$C_{10}H_{18}O$	Geraniol	−150 to 50	3.33×10^3	(*)	(*)	46.1	Schallamach.
140	$C_{10}H_{21}Br$	1-Bromodecane	1	∞	4.75		52.5	Smyth et al.
				10.0	3.42	0.72	52.1	
				3.22	2.71	.63	52.7	
				1.27	2.50	.32	52.4	
			25	∞	4.44			
				10.0	3.52	.57		
				3.22	2.88	.71		
				1.27	2.59	.42		
			40	∞	4.28			
				10.0	3.54	.50		
				3.22	2.97	.71		
				1.27	2.59	.47		
			55	∞	4.12			
				10.0	3.54	.45		
				3.22	3.05	.69		
				1.27	2.63	.51		
			75	10.0	3.53	.38		
141	$C_{10}H_{21}Cl$	1-Chlorodecane	24.5	8 to 150			42	Klages.
142	$C_{10}H_{22}O$	1-Decanol	20	3×10^4	7.75		55.2	Lebrun.
				2.38×10^3	7.6	.72		
				1.50×10^3	7.56	.97		
				810	7.15	1.74		
				650	6.76	1.86		
				553	6.5	2.08		
				431	6.06	2.16		
				313	5.41	2.32		
				231.7	4.89	2.22		
				188	4.42	2.09		
				153	4.05	1.84		
				104	3.68	1.55		
				78.7	3.50	1.36		
				60.15	3.32	1.14		
				43.8	3.24	0.95		
				21.6	2.97	.67		
				17.23	2.86	.57		
				9.46	2.72	.45		
				3.17	2.49	.26		
			25	3×10^5	7.80		55.1	Lebrun.
				3×10^4	7.80			
				5×10^3	7.78	.25		
				3.0×10^3	7.72	.44		
				1.43×10^3	7.60	.94		
				910	7.33	1.35		
				630	7.00	1.86		
				313	5.08	2.32		
				185	4.27	2.05		
				104.2	3.49	1.43		
				60	3.25	1.18		
				9.1	2.76	0.44		
				3.20	2.48	.20		
			2.5	10.0	2.54	.231	56.4	Smyth et al.
			8.4	1.25	2.353	.105		
			20	10.0	2.68	.34		
				3.22	2.48	.29		
				1.25	2.365	.134		
			40	10.0	2.92	.527		
				3.22	2.574	.356		
				1.25	2.41	.20		
			60	10.0	3.21	.747		
				3.22	2.672	.481		
				1.25	2.47	.29		
			82	1.25	2.58	.41		
			20	9.0	2.78	.40	52.2	Bruma.
			20	3 to 2.2×10^3	(*)	(*)	47	Girard.
			0 to 60	9.0	(*)	(*)	54	Brot.
			−50 to 50	1.25	(*)	(*)	55	Brot.
		C_{11}						
143	$C_{11}H_{24}O$	1-Undecanol	25	3×10^5	6.45	------------	55.1	Lebrun.
				3×10^4	6.45	------------		
				5×10^3	6.41	0.19		
				3.0×10^3	6.40	.31		
				1.43×10^3	6.33	.65		

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.		Substance	t (°C)	λ (cm)	ε′	ε″	References	
		C_{11}—Continued						
143	$C_{11}H_{24}O$	1-Undecanol—Continued		910	6.16	0.98		
				630	6.04	1.20		
				313	4.81	1.62		
				185	4.01	1.51		
				104.2	3.46	1.16		
				60.	3.32	1.02		
				9.1	2.79	0.42		
				3.20	2.46	.20		
		C_{12}						
144	$C_{12}F_{26}O$	Perfluorodihexyl ether	25	∞	1.87		53	MIT.
				100	1.86	.0055		
				10	1.86	.0122		
				3	1.85	.092		
145	$C_{12}F_{27}N$	Heptacosafluorotributyl amine	25	∞	1.85_3		53	MIT.
				300	1.85	.0011		
				100	1.85	.0025		
				10	1.85	.0028		
				3	1.85	.0020		
146	$C_{12}H_9Cl$	3-Chlorobiphenyl	24.5	8 to 150			42	Klages.
147	$C_{12}H_{10}O$	2-Acetonaphthone	60	∞	13.03		56.1	Smyth et al.
				10.4	4.73	2.49		
				3.22	3.65	1.16		
				1.24	3.43	0.60		
			70	∞	12.49			
				10.4	5.24	2.83		
				3.22	3.65	1.36		
				1.24	3.42	0.68		
			80	∞	12.15			
				10.4	5.63	3.29		
				3.22	3.83	1.57		
				1.24	3.47	0.78		
			90	∞	12.01			
				3.22	3.88	1.71		
				1.24	3.47	0.87		
148		Phenyl ether	40	∞	3.61		56.1	Smyth et al.
				10.4	3.56	.123		
				3.22	3.43	.295		
				1.24	3.17	.397		
			60	∞	3.47			
				10.4	3.46	.085		
				3.22	3.39	.222		
				1.24	3.18	.360		
			80	∞	3.35			
				10.4	3.35	.061		
				3.22	3.31	.162		
				1.24	3.19	.312		
			10 to 50	3			50	Dodd.
149	$C_{12}H_{20}O_2$	Geranyl acetate	−70 to 20	112			46.2	Schallamach.
150	$C_{12}H_{24}O_2$	Dodecanoic acid (Lauric)	(?)	1 to 50	(*)	(*)	54	Buchanan.
151	$C_{12}H_{25}Br$	1-Bromododecane	1	∞	4.31		52.5	Smyth et al.
				10.60	3.60	0.65	52.1	
				8.75	3.00	.64		
				3.22	2.52	.42		
				1.27	2.40	.23		
			25	∞	4.07			
				12.74	3.08	.53		
				10.60	3.27	.57		
				8.75	3.20	.58		
				3.22	2.64	.51		
				1.27	2.43	.31		
			40	∞	3.93			
				12.74	3.10	.45		
				10.60	3.32	.52		
				8.75	3.26	.55		
				3.22	2.69	.54		
				1.27	2.45	.36		
			55	∞	3.80			
				12.74	3.11	.40		
				10.60	3.32	.45		
				8.75	3.29	.50		
				3.22	2.75	.54		
				1.27	2.49	40		
			75	12.74	3.26	.25		
				10.0	3.27	.39		
				8.75	3.28	.40		

*Graphs.

No.	Substance	t (°C)	λ (cm)	ε′	ε″	References
	C_{12}—Continued					
152	$C_{12}H_{25}Cl$ 1-Chlorododecane	1	∞	4.45		52.5 Smyth et al.
			1.27	2.45	0.32	52.4
		25	∞	4.17		
			1.27	2.50	.41	
		40	∞	3.99		
			1.27	2.55	.45	
		55	∞	3.85		
			1.27	2.58	.49	
		−10 to 20	1.08×10^3			50 Klages.
153	$C_{12}H_{26}O$ 1-Dodecanol	25	3×10^5	6.37		55.1 Lebrun.
			3×10^4	6.35		
			5×10^3	6.30	.23	
			3.0×10^3	6.35	.35	
			1.43×10^3	6.16	.79	
			910	5.95	1.12	
			630	5.72	1.32	
			313	4.19	1.59	
			185	3.46	1.35	
			104.2	3.16	0.99	
			60.	3.00	.71	
			9.1	2.68	.34	
			3.20	2.44	.167	
		25	∞	6.5		56.4 Smyth et al.
			10.0	2.575	.300	
			3.22	2.446	.192	
			1.25	2.347	.121	
		55	∞	4.56		
			10.0	2.844	.525	
			3.22	2.585	.327	
			1.25	2.427	.201	
		85	∞	4.00		
			10.0	3.323	.644	
			3.22	2.80	.44	
			1.25	2.539	.312	
		20 to 60	9.0	(*)	(*)	54 Brot.
			3.22			
		−50 to 50	1.25	(*)	(*)	55 Brot.
		25 to 50	3.12×10^3			50 Klages.
		40	1.08×10^3			
	C_{13}					
154	$C_{13}H_{10}O$ Benzophenone	50	∞	11.4		[k] 56.6 Smyth et al.
			3.22	3.72	1.60	
			1.25	3.23	1.25	
		70	∞	11.3		
			3.22	4.10	2.23	
			1.25	3.30	1.26	
		85	∞	10.12		
			3.22	4.45	2.55	
			1.25	3.41	1.38	
		60	∞	10.91		[l] 56.1 Smyth et al.
			10.4	6.21	3.92	
			3.22	3.82	1.91	
			1.24	3.37	0.95	
		70	∞	10.54		
			10.4	6.96	3.86	
			3.22	3.91	2.10	
			1.24	3.38	1.10	
		80	∞	10.23		
			10.4	7.51	3.56	
			3.22	4.24	2.33	
			1.24	3.38	1.22	
		90	∞	9.99		
			3.22	4.44	2.52	
			1.24	3.39	1.33	
155	$C_{13}H_{26}O_2$ Methyl laurate	20	9.	3.44	0.18	52.2 Bruma.
	C_{14}					
156	$C_{14}H_{29}Br$ 1-Bromotetradecane	1	∞	4.04		52.5 Smyth et al.
			10.0	----------	----------	52.1
			3.22	2.52	0.37	52.7
			1.27	2.37	.19	52.4
		25	∞	3.84		
			10.60	3.08	.53	
			3.22	2.64	.47	
			1.27	2.40	.26	

*Graphs. [k] mp=48.2 (mp 48.1, Timmermans (50)). [l] mp=47.4.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References
		C_{14}—Continued					
156	$C_{14}H_{29}Br$	1-Bromotetradecane—Continued	40	∞	3.73		
				10.60	3.10	0.45	
				3.22	2.69	.49	
				1.27	2.40	.30	
			55	∞	3.61		
				10.60	3.11	.40	
				3.22	2.75	.50	
				1.27	2.42	.33	
			75	10.60	3.26	.29	
157	$C_{14}H_{30}O$	1-Tetradecanol	40	∞	4.66		56.4 Smyth et al.
				10.0	2.632	.320	
				3.22	2.45	.18	
				1.25	2.381	.132	
			60	1.25	2.43	.16	
			80	∞	3.69		
				10.0	3.01	.44	
				1.25	2.515	.26	
		C_{15}					
158	$C_{15}H_{30}O$	8-Pentadecanone	45	∞	----------		56.6 Smyth et al.
				10.0	----------	----------	
				3.22	----------	----------	
				1.25	2.74	.833	
			50	∞	----------		
				10.0	5.137	1.60	
				3.22	3.43	1.4	
				1.25			
			65	∞	----------		
				10.0	5.240	1.30	
				3.22	3.62	1.46	
				1.25	----------	----------	
			80	∞	----------		
				10.0	5.116	1.05	
				3.22	3.76	1.41	
				1.25	----------	----------	
			82	∞	----------		
				10.0	----------	----------	
				3.22	----------	----------	
				1.25	2.81	1.02	
159	$C_{15}H_{30}O_2$	Methyl myristate	20	9.	3.24	0.16	52.2 Bruma.
		C_{16}					
160	$C_{16}H_{32}O_2$	Hexadecanoic acid (Palmitic)	19 to 75	254			47 Aref′ev.
				8 to 50	(*)	(*)	54 Buchanan.
161	$C_{16}H_{33}Br$	1-Bromohexadecane	25	∞	3.68		52.5 Smyth et al.
				10.0	2.96	0.38	52.1
				3.22	2.52	.37	52.7
				1.27	2.35	.21	52.4
			40	∞	3.57		
				10.0	3.00	.34	
				3.22	2.57	.40	
				1.27	2.38	.25	
			55	∞	3.46		
				10.0	3.02	.30	
				3.22	2.62	.41	
				1.27	2.39	.28	
			75	10.0	3.04	.25	
162	$C_{16}H_{33}Cl$	1-Chlorohexadecane	24.5	8 to 150			42 Klages.
163	$C_{16}H_{34}O$	1-Hexadecanol	55	∞	3.77		56.4 Smyth et al.
				10.0	2.689	.338	
				3.22	2.482	.234	
				1.25	2.37	.163	
			70	∞	3.50		
				10.0	2.837	.390	
				3.22	2.573	.287	
				1.25	2.41	.209	
			82	1.25	2.44	.241	
			50 to 70	1.08×10^3	(*)	(*)	50 Klages. 52 Hamon.
		C_{17}					
164	$C_{17}H_{34}O$	9-Heptadecanone	55	∞	5.43		56.6 Smyth et al.
				10.0	4.49	1.34	
				3.22	3.19	1.11	
				1.25	2.60	0.67	

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Formula	Substance	t (°C)	λ (cm)	ε′	ε″	References	
		C_{17}—Continued						
164	$C_{17}H_{34}O$	9-Heptadecanone—Continued	70	∞	5.13			
				10.0	4.56	1.13		
				3.22	3.32	1.15		
				1.25	----------	----------		
			80	∞	4.93			
				10.0	4.58	0.903		
				3.22	3.44	1.12		
				1.25	2.74	0.79		
165	$C_{17}H_{34}O_2$	Methyl palmitate	31 to 65	3.2 to 30	(*)	(*)	54	Buchanan.
		C_{18}						
166	$C_{18}H_{32}O_2$	Linoleic acid	−85 to 120	344			45	Stepanenko.
			−10 to 40	64			53	Bogdanov.
167	$C_{18}H_{34}O_2$	Oleic acid	−110 to 100	344			45	Stepanenko.
168	$C_{18}H_{34}O_4$	Dibutyl sebacate	25	∞	4.59		53	MIT.
				3×10^4	4.58	0.0014		
				3×10^3	4.56	.0073		
				100	4.55	.174		
				10	3.80	.81		
169	$C_{18}H_{36}O_2$	Ethyl palmitate	26 to 75	3.2 to 30	(*)	(*)	54	Buchanan.
170		Cetyl acetate	35	∞	3.19		52.8	Smyth et al.
				10.0	2.97	0.22		
				3.22	2.76	.27		
				1.25	2.56	.27		
			55	∞	3.09			
				10.0	2.94	.20		
				3.22	2.76	.25		
				1.25	2.56	.27		
			75	∞	2.99			
				10.0	2.89	.15		
				3.22	2.75	.22		
				1.25	2.56	.27		
171	$C_{18}H_{38}O$	1-Octadecanol	60	∞	3.34		56.3	Smyth et al.
				10.0	2.661	.293		
				1.25	2.356	.152		
			85	∞	3.124			
				10.0	2.853	.285		
				1.25	2.448	.214		
		C_{20}						
172	$C_{20}H_{40}O$	Phytol	−150 to 50	3.33×10^3	(*)	(*)	46.2	Schallamach.
173	$C_{20}H_{40}O_2$	Octadecyl acetate	35	∞	3.07		52.8	Smyth et al.
				10.0	2.92	0.21		
				3.22	2.68	.22		
				1.25	2.51	.25		
			55	∞	2.98			
				10.0	2.85	.17		
				1.25	2.52	.25		
			75	∞	2.89			
				10.0	2.80	.14		
				1.25	2.52	.14		
174	$C_{20}H_{42}O$	Di-dihydrocitronellyl ether	−130 to 20	1.50×10^5	(*)	(*)	46.1	Schallamach.
175	$C_{20}H_{42}O_2$	Decyl ether	20	∞	2.644		56.6	Smyth et al.
				10.0	2.357	0.144		
				3.22	2.238	.103		
				1.25	2.193	.13		
			40	∞	2.565			
				10.0	2.392	.146		
				3.22	2.247	.114		
				1.25	2.181	.13		
			60	∞	2.489			
				10.0				
				3.22	2.256	.116		
				1.25	2.169	.13		
		C_{21}						
176	$C_{21}H_{42}O_4$	Monostearin	80	∞	4.84		52.8	Smyth et al.
				10.0	3.75	.81		
				3.22	3.13	.64		
				1.25	2.87	.45		
			90	∞	4.74			
				10.0	3.87	.73		
				3.22	3.22	.68		
				1.25	2.87	.48		
		C_{22}						
177	$C_{22}H_{32}O_2$	Ethyl abietate	−70 to 20	3×10^5 to 3×10^7			40	Morgan.
178	$C_{22}H_{42}O_2$	Phytyl acetate	−190 to 50	1.12×10^2 to 1.09×10^5	(*)	(*)	46.2	Schallamach.

*Graphs.

TABLE 4. *Dielectric dispersion data for pure organic liquids*—Continued

No.	Substance		t (°C)	λ (cm)	ε′	ε″	References
		C_{26}					
179	$C_{26}H_{50}O_4$	Dioctyl sebacate	26	∞	4.05		53 MIT.
				3×10^4	4.01	0.0028	
				3×10^3	4.00	.022	
				100	3.77	.39	
				10	2.75	.36	
		C_{28}					
180	$C_{28}H_{56}O_2$	Decyl stearate	40	∞	2.81		52.8 Smyth et al.
				10.0	2.58	.181	
				3.22	2.40	.168	
				1.25	2.29	.135	
			60	∞	2.73		
				10.0	2.58	.164	
				3.22	2.41	.178	
				1.25	2.29	.140	
			80	∞	2.65		
				10.0	2.56	.143	
				1.25	2.26	.140	
		C_{30}					
181	$C_{30}H_{58}O_4$	Ethylene dimyristate	70	∞	2.98		52.8 Smyth et al.
				10.0	2.87	.23	
				3.22	2.64	.28	
				1.25	2.44	.26	
			80	∞	2.98		
				10.0	2.87	.22	
				3.22	2.66	.20	
182	$C_{30}H_{60}O_2$	Tetradecy palmitate	50	∞	2.66		52.8 Smyth et al.
				10.0	2.52	.176	
				1.25	2.30	.156	
			82	∞	2.72		
				10.0	2.54	.152	
				1.25	2.28	.16	
		C_{32}					
183	$C_{32}H_{64}O_2$	Tetradecyl stearate	50	∞	2.67		52.8 Smyth et al.
				1.25	2.28	.126	
			82	∞	2.57		
				1.25	2.28	.145	
		C_{34}					
184	$C_{34}H_{66}O_4$	Ethylene dipalmitate	75	∞	2.89		52.8 Smyth et al.
				10.0	2.77	.20	
				3.22	2.58	.22	
				1.25	2.41	.21	
185	$C_{34}H_{68}O_2$	Cetyl stearate	60	∞	2.61		52.8 Smyth et al.
				10.0	2.46	.130	
				3.22	2.35	.141	
				1.25	2.28	.126	
			80	∞	2.54		
				10.0	2.47	.118	
				3.22	2.36	.138	
				1.25	2.26	.140	
		C_{38}					
186	$C_{38}H_{74}O_4$	Ethylene distearate	80	∞	2.79		52.8 Smyth et al.
				10.0	2.69	.18	
				3.22	2.53	.19	
				1.25	2.39	.15	
		C_{39}					
187	$C_{39}H_{76}O_5$	Distearin	80	∞	3.25		52.8 Smyth et al.
				10.0	2.88	.305	
				3.22	2.65	.272	
				1.25	2.48	.204	
			90	∞	3.22		
				10.0	2.92	.272	
				3.22	2.67	.282	
				1.25	2.49	.226	
		C_{51}					
188	$C_{51}H_{98}O_6$	Tripalmitin	−45 to 120	63.8			52 Bogdanov.
		C_{57}					
189	$C_{57}H_{104}O_6$	Triolein	−50 to 93	344			45 Stepanenko.
190	$C_{57}H_{110}O_6$	Tristearin	80	∞	2.74		52.8 Smyth et al.
				10.0	2.49	.124	
				3.22	2.39	.124	
				1.25	2.31	.089	
			90	∞	2.735		
				10.0	2.49	.124	
				3.22	2.39	.122	
				1.25	2.31	.088	
			−40 to 83	344			45 Stepanenko.

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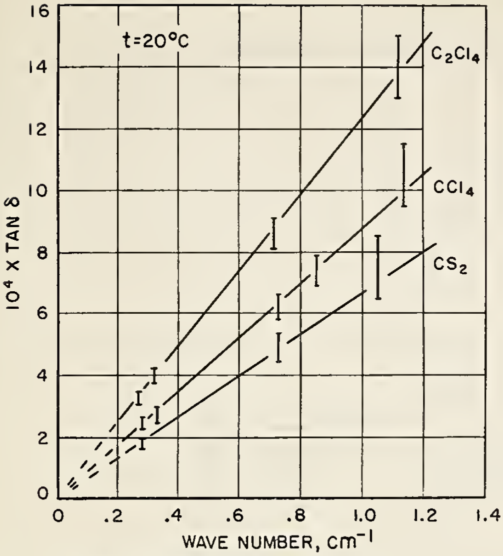
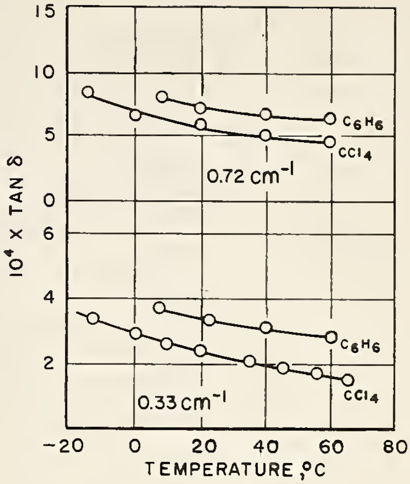
Graphical Representations of Dielectric Data for Pure Liquids

The graphs are placed in the order of the ordinal numbers assigned in tables 1 to 4.

The graphs are reproductions from the literature, but have been relabeled to conform to a consistent nomenclature.

No. 7. CCl_4, Carbon tetrachloride. Whiffen (50).

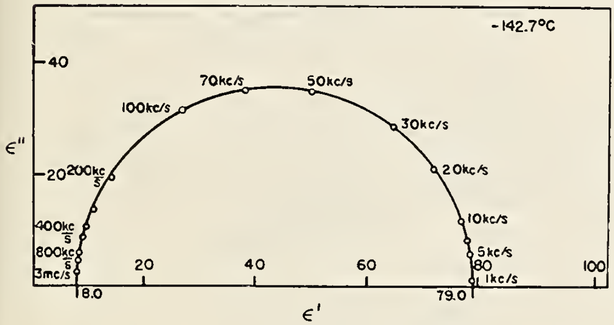


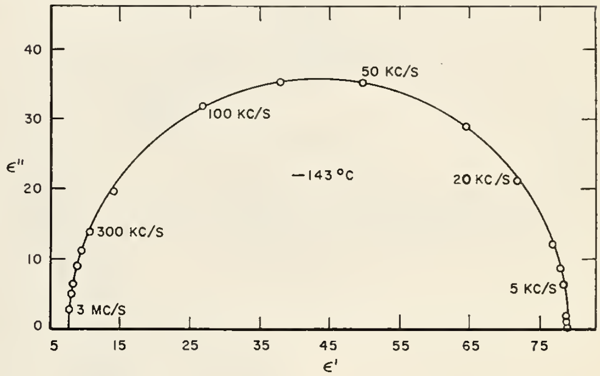


No. 8. CS_2, Carbon disulfide. Cf. No. 7.
No. 13. C_2Cl_4, Tetrachloroethylene. Cf. No. 7.

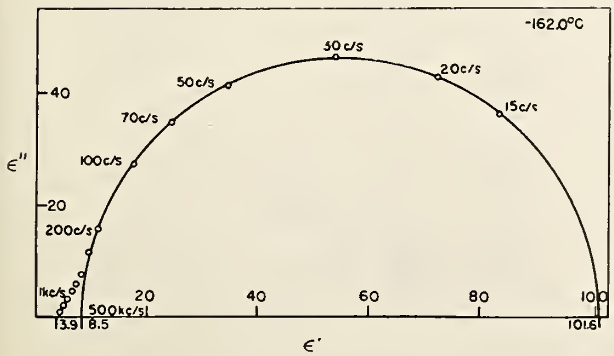
No. 21. C_2H_6O, Ethanol. Hassion (55).

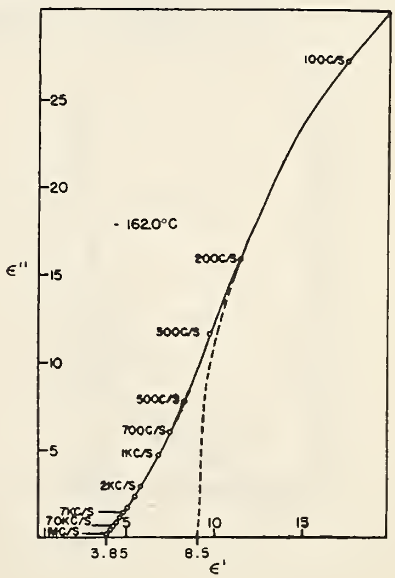
Hassion (53).



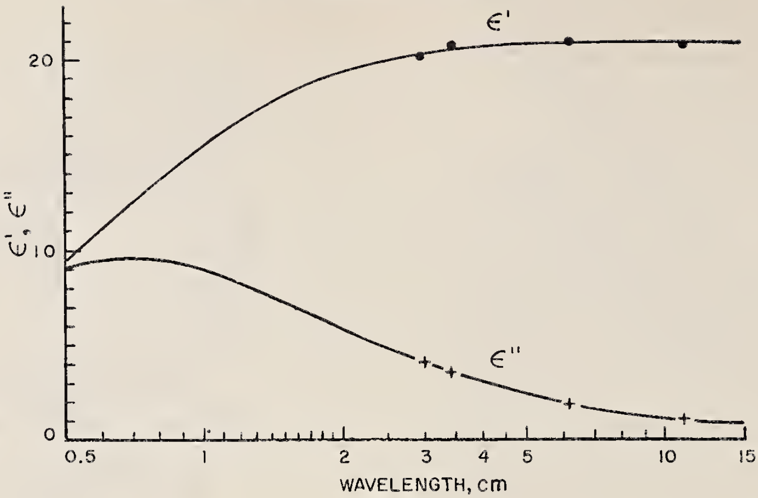


C_2H_6O, Ethanol (1% H_2O). Hassion (53).



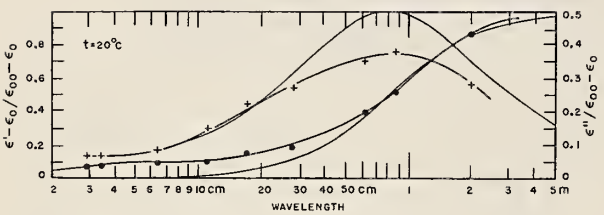


No. 29. C_3H_6O, Acetone. Abadie (46).

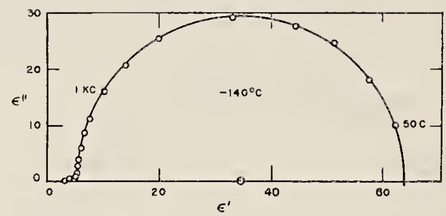


No. 35. C_3H_8O, 1-Propanol.

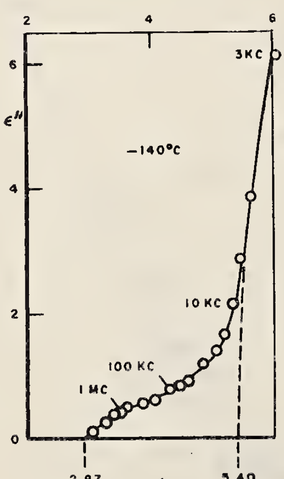
Girard (42).



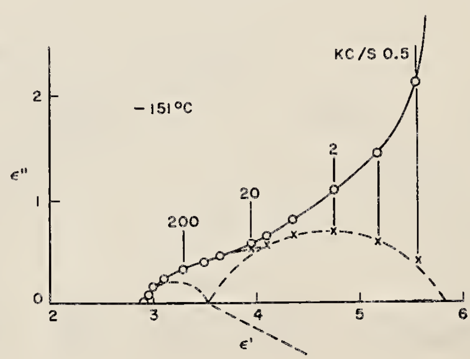
Davidson (51).



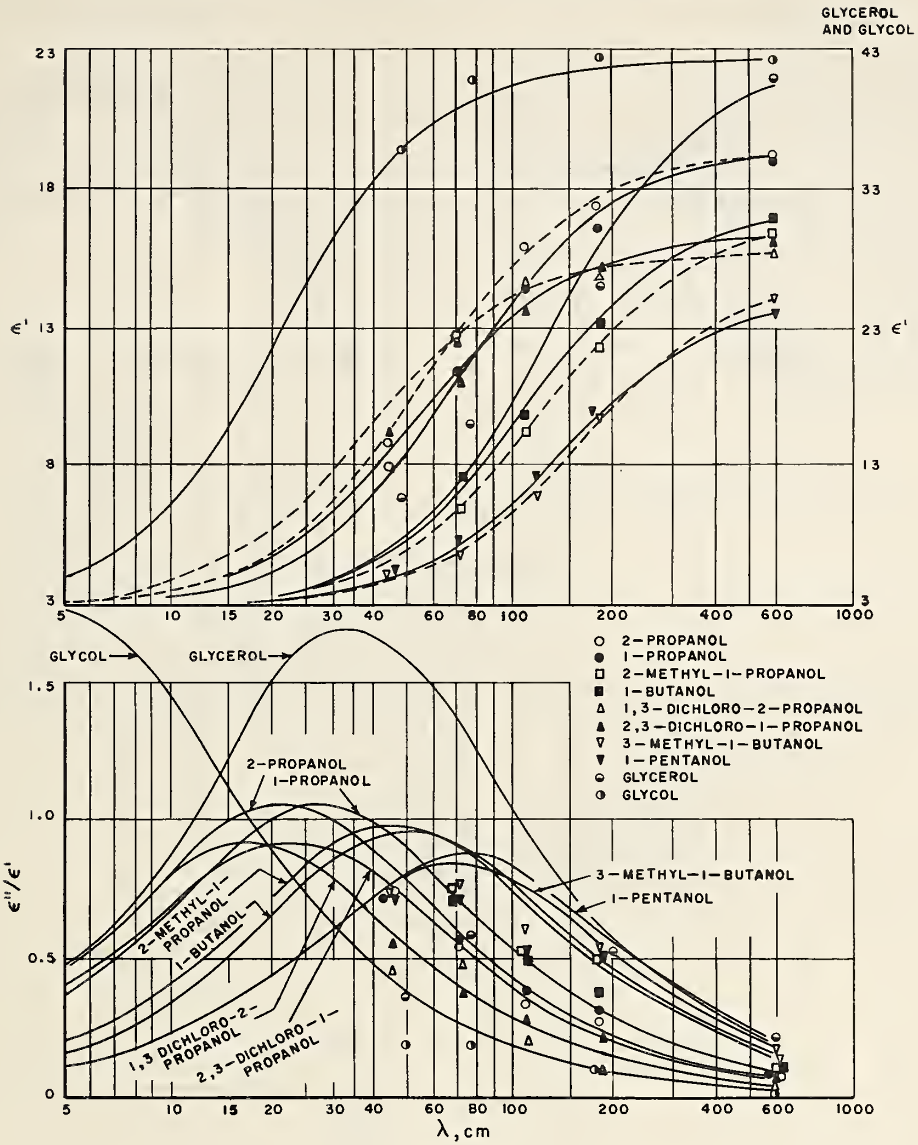
Davidson (51).



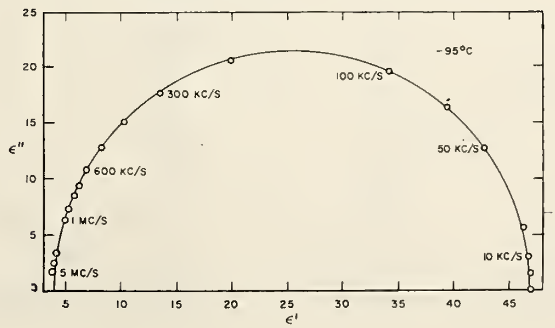
Cole (52).



No. 35. C_3H_8O, 1-Propanol—Continued. Girard (32).

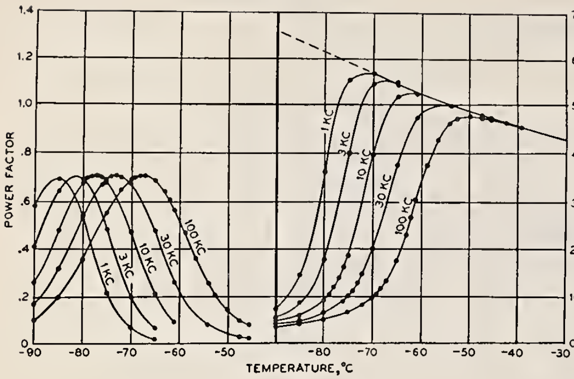


No. 36. C_3H_8O, 2-Propanol. Hassion (55).

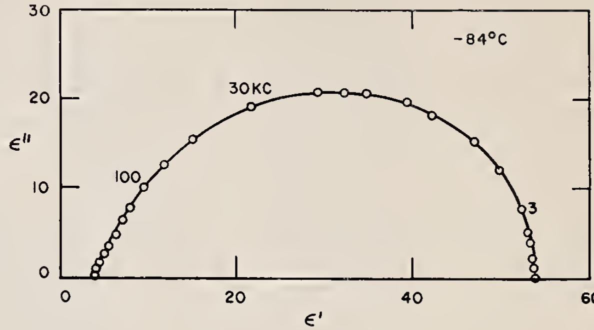


No. 37. $C_3H_8O_2$, 1,2-Propanediol.

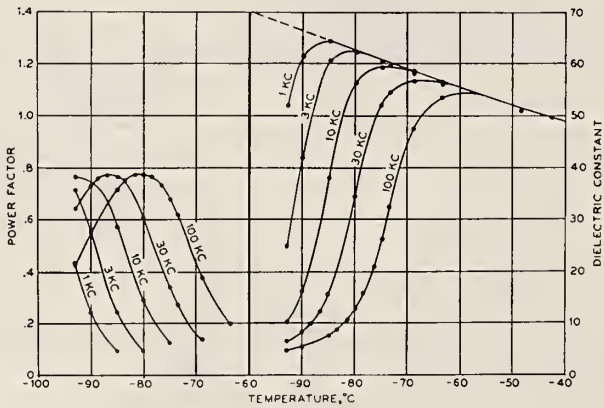
White (32).



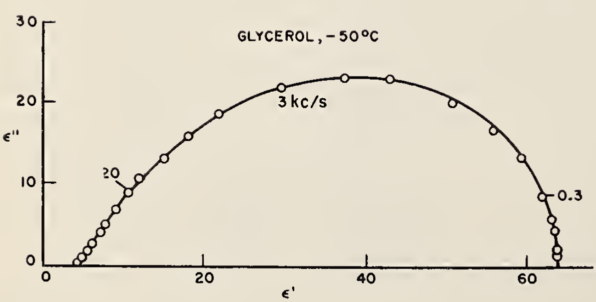
Davidson (51).

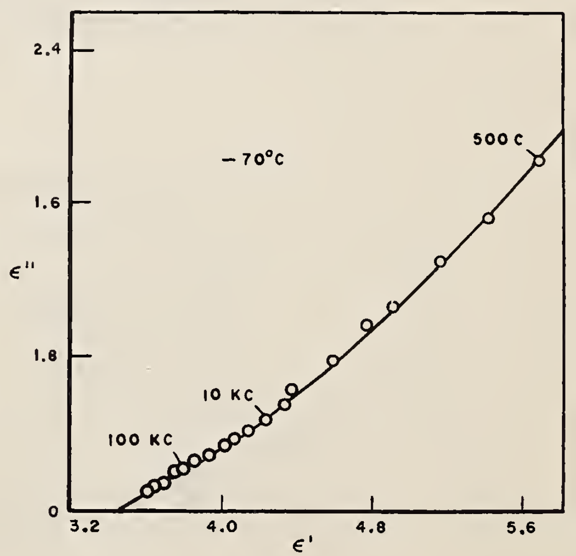


No. 38. $C_3H_8O_2$, 1,3-Propanediol. White (32).

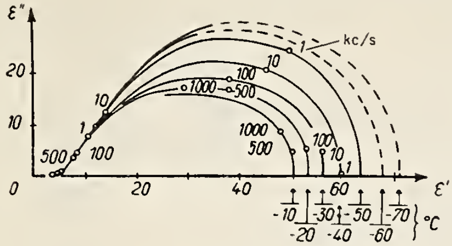


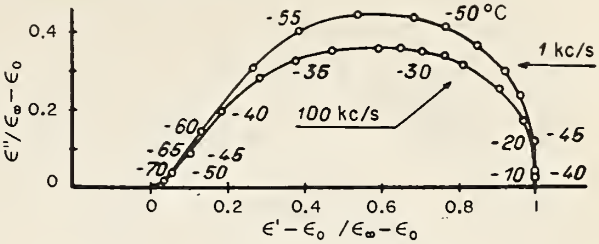
No. 39. $C_3H_8O_3$, Glycerol. Davidson (51).

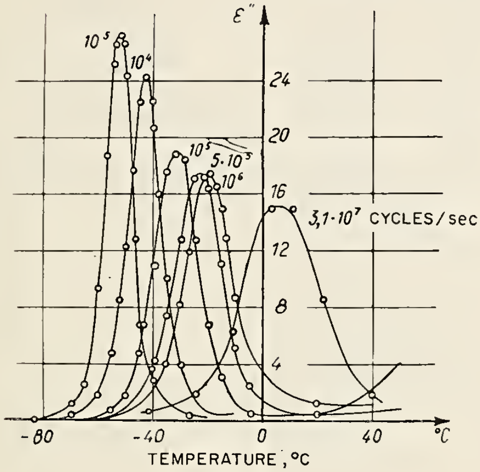


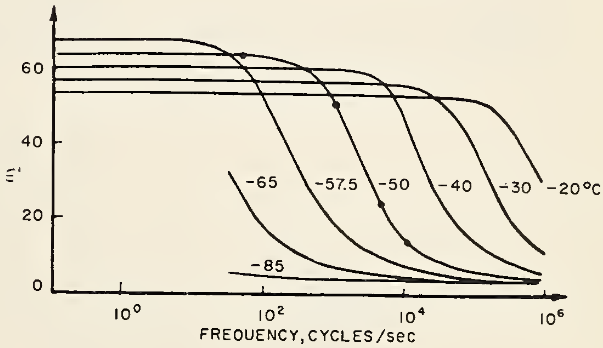


No. 39. $C_3H_8O_3$, Glycerol—Continued. Schulz (54).

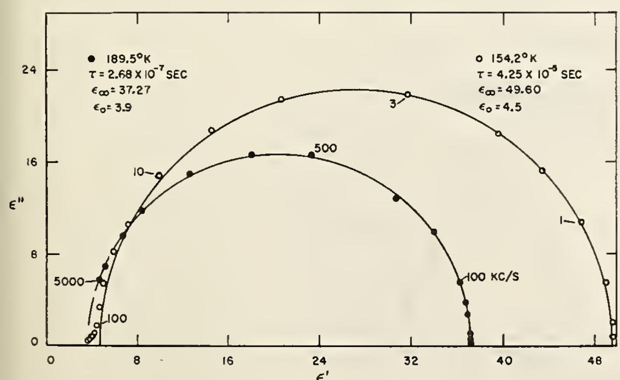


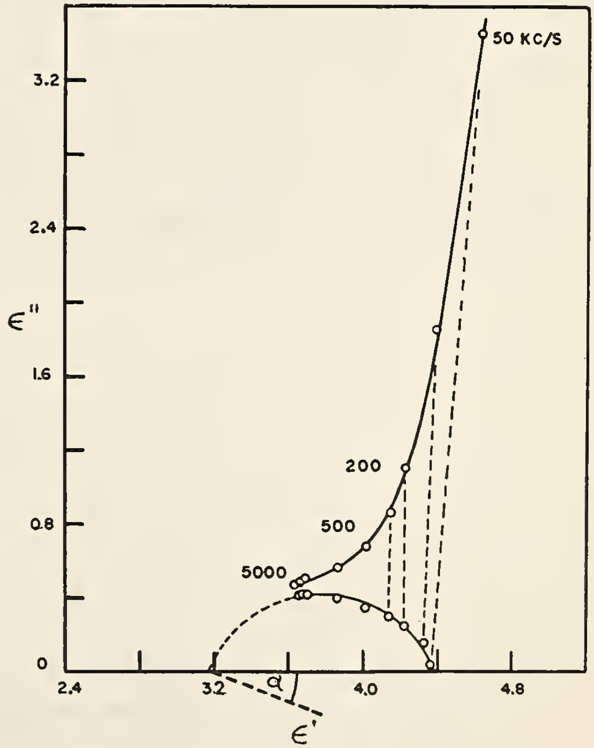




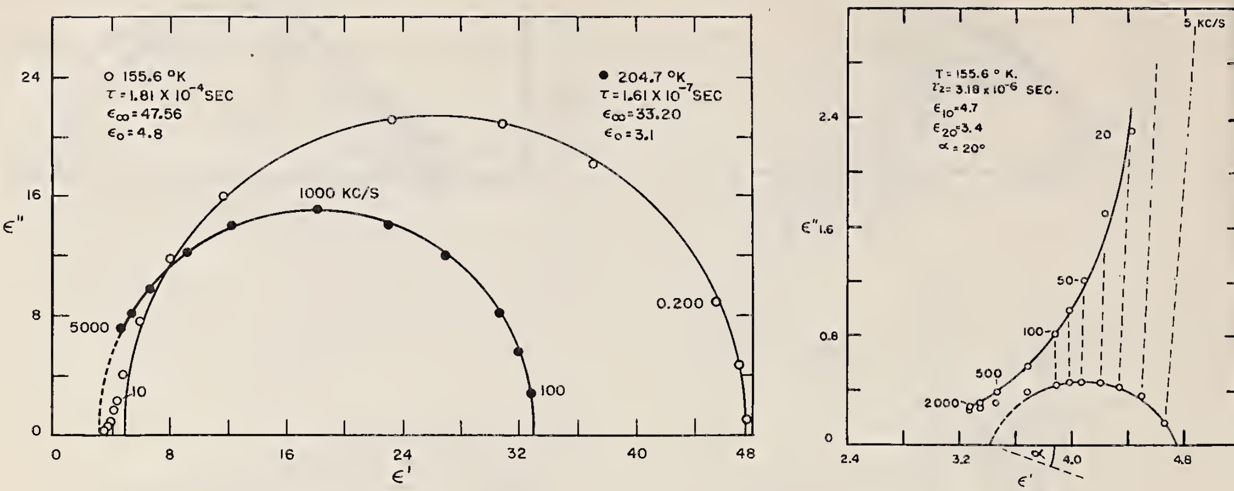


No. 59. $C_4H_{10}O$, 1-Butanol. Dannhauser (55).

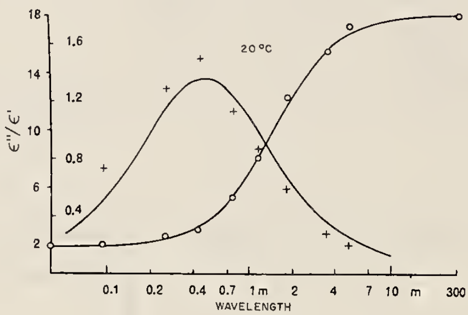




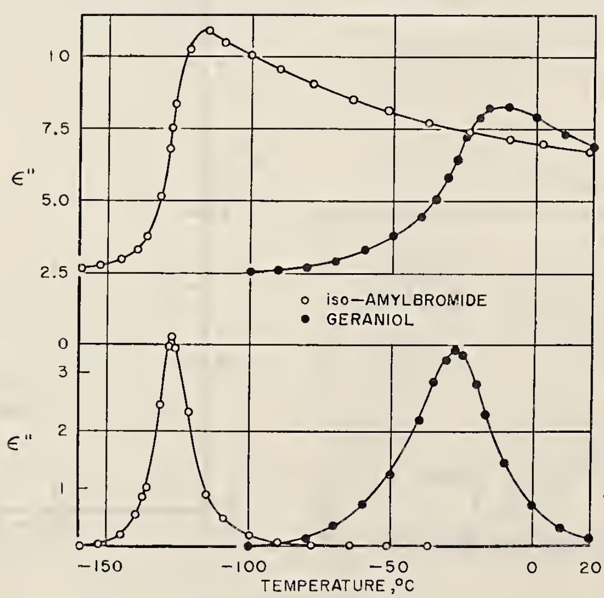
No. 61. $C_4H_{10}O$, 2-Methyl-1-propanol. Dannhauser (54).



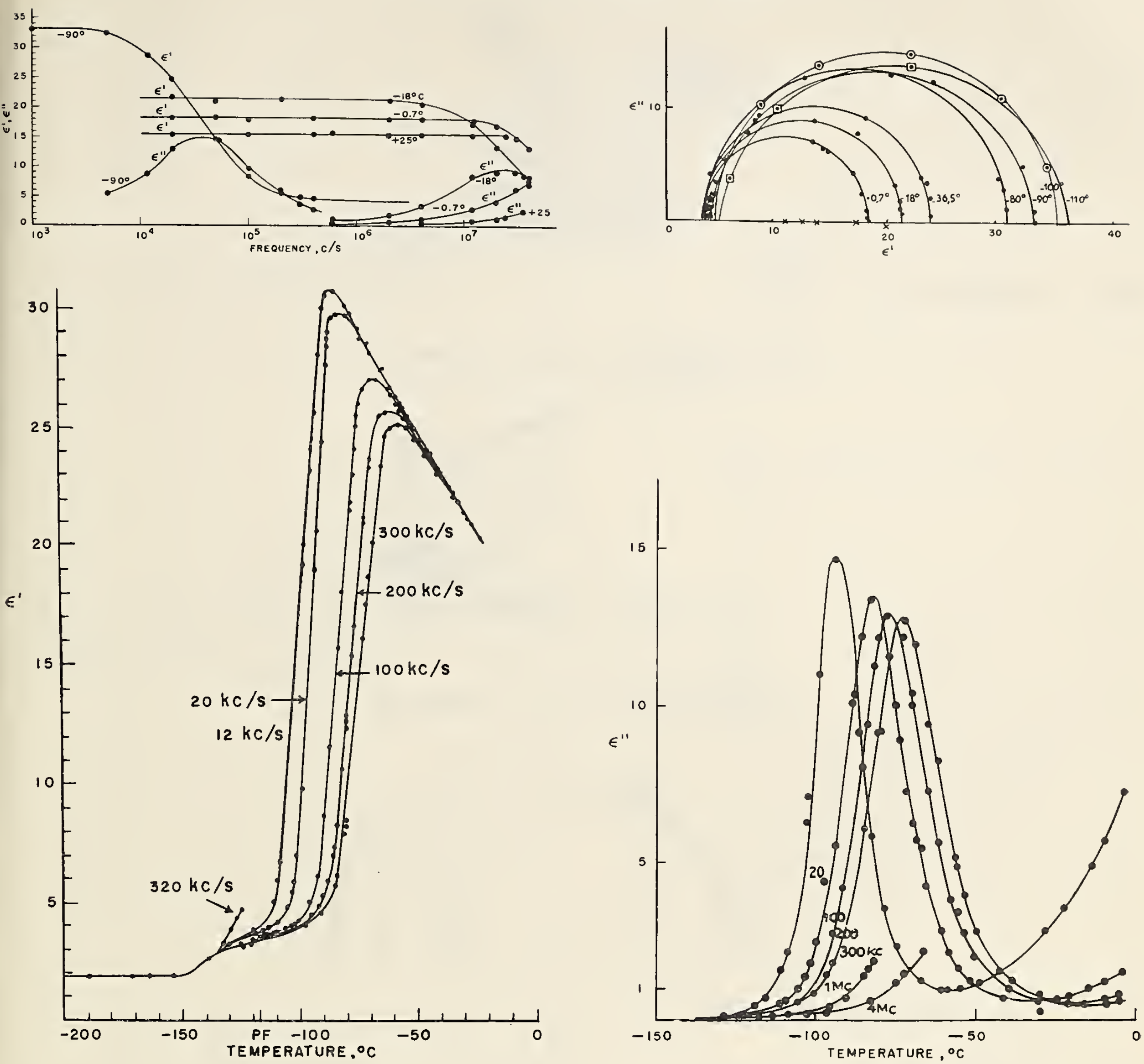
Häfelin (46)



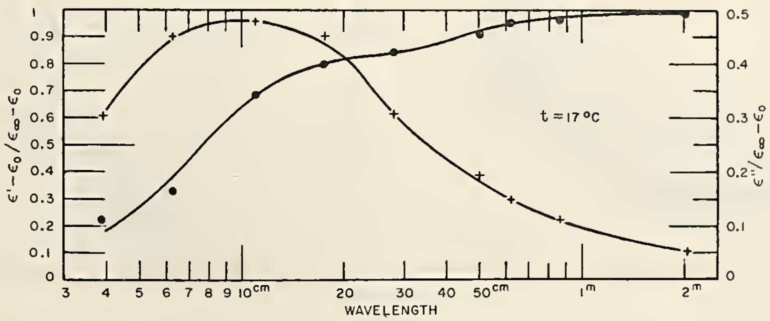
No. 67. $C_5H_{11}Br$, 1-Bromo-3-methyl butane. Schallamach (46.0).



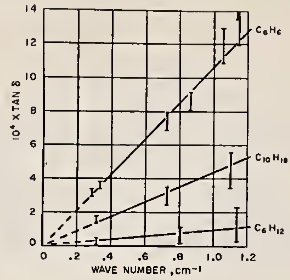
No. 71. $C_5H_{12}O$, 3-Methyl-1-butanol. Reinisch (54).



No. 79. $C_6H_5NO_2$, Nitrobenzene. Girard (43).

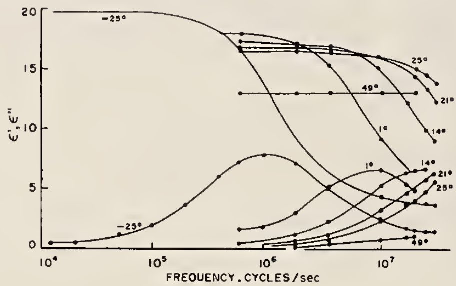


No. 80. C_6H_6, Benzene. Whiffen (50)

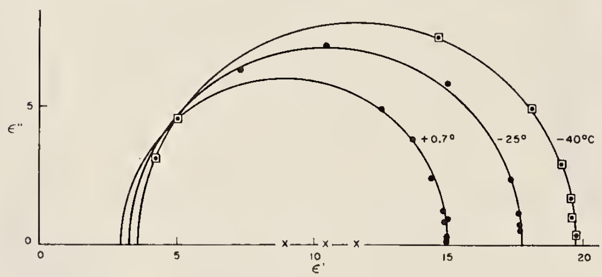


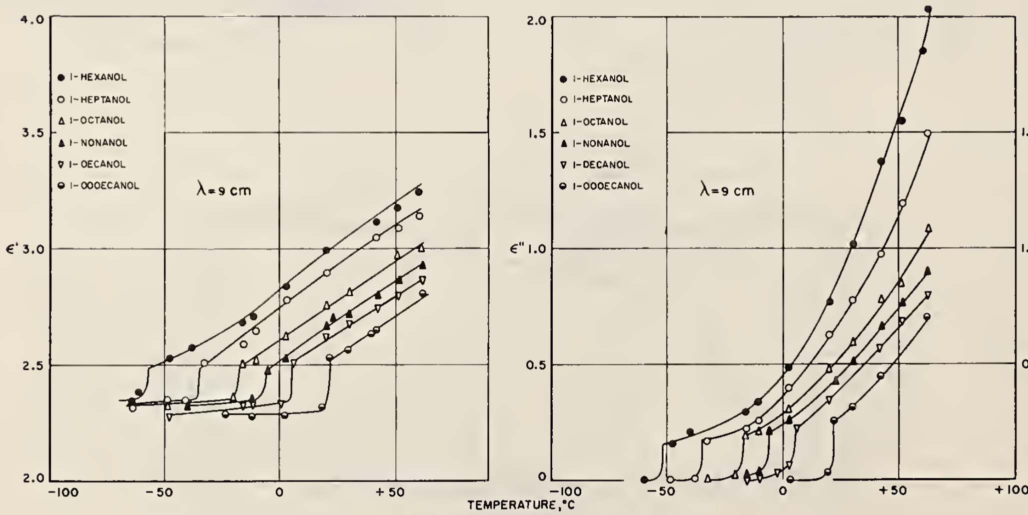
No. 88. C_6H_{12}, Cyclohexane. Cf. No. 80.

No. 89. $C_6H_{12}O$, Cyclohexanol. Reinisch (53).



No. 93. $C_6H_{14}O$, 1-Hexanol. Reinisch (54).





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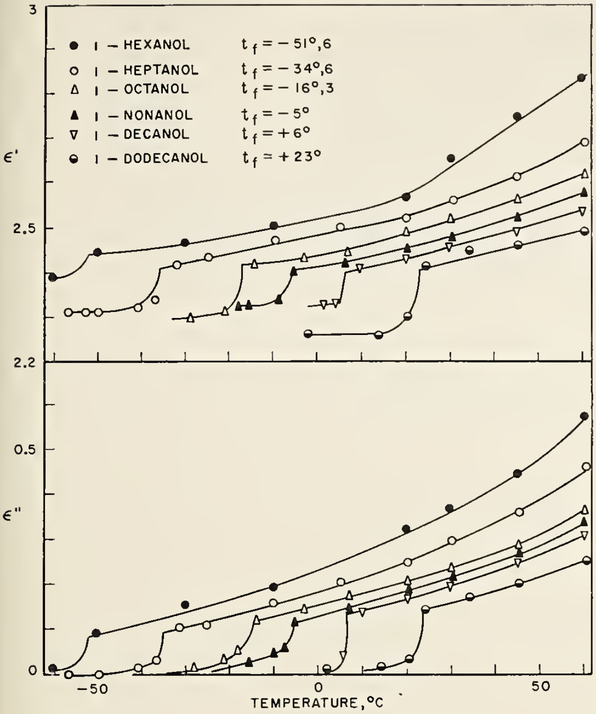

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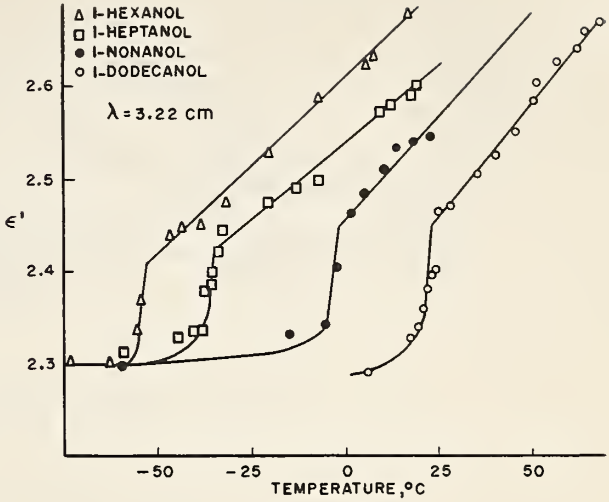
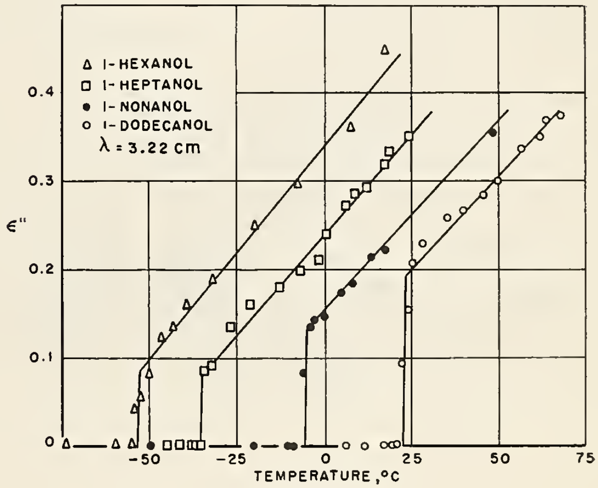
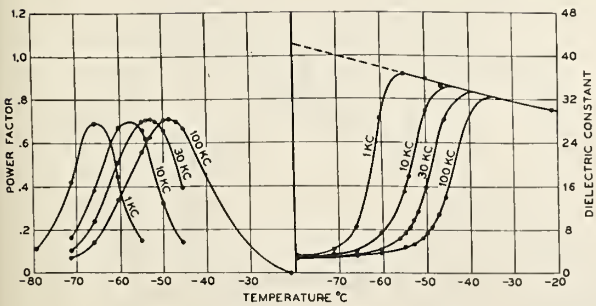
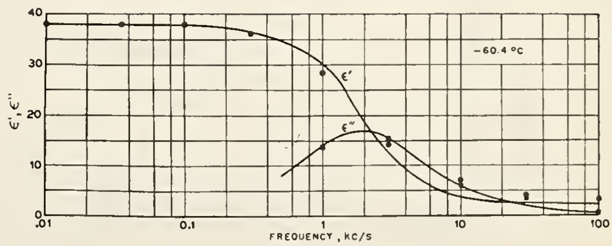


Brot (53).

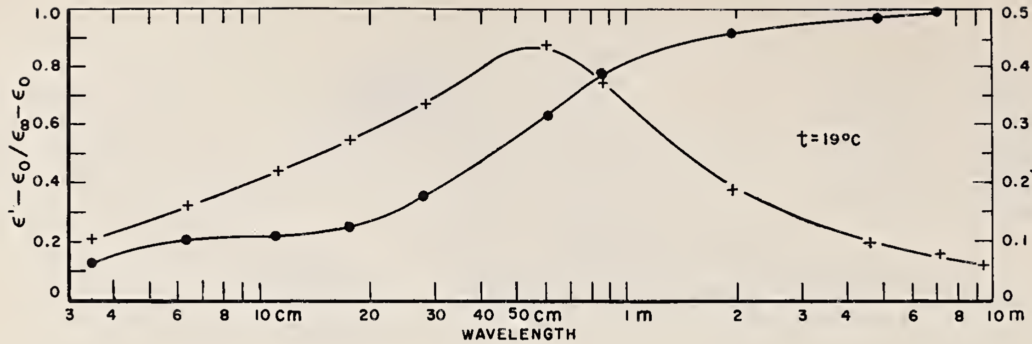


No. 94. $C_6H_{14}O_2$, 2-Methyl-2,4-pentanediol. White (32).

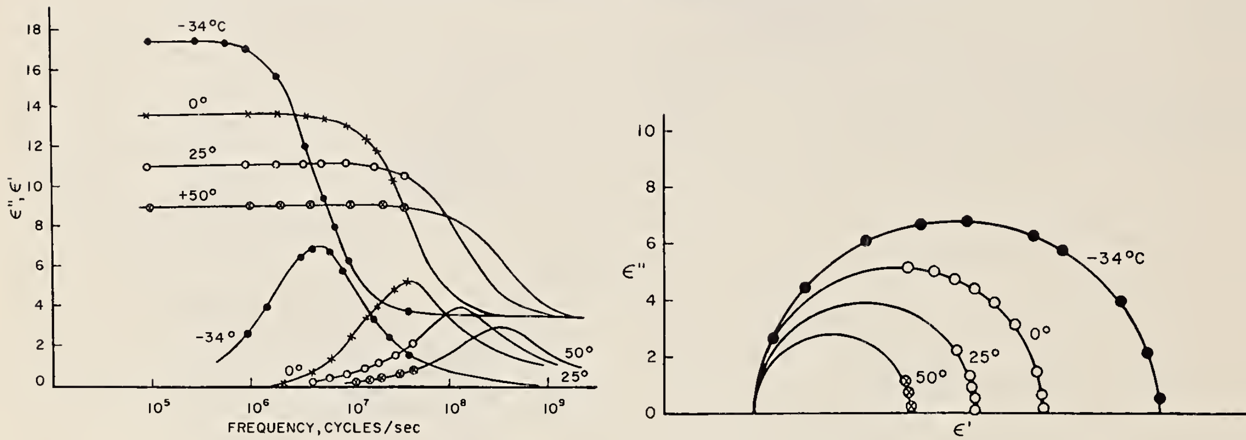




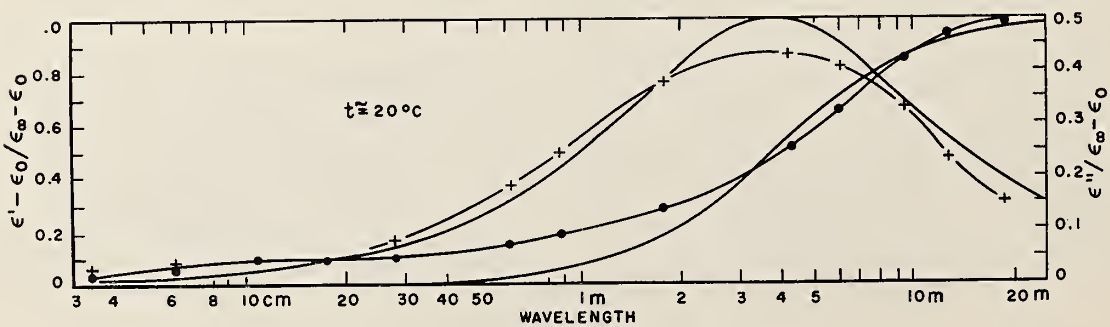
No. 100. C_7H_8O, Benzyl alcohol. Girard (43).



No. 114. $C_7H_{16}O$, 1-Heptanol. Oppenheim (51). Cf. No. 67.

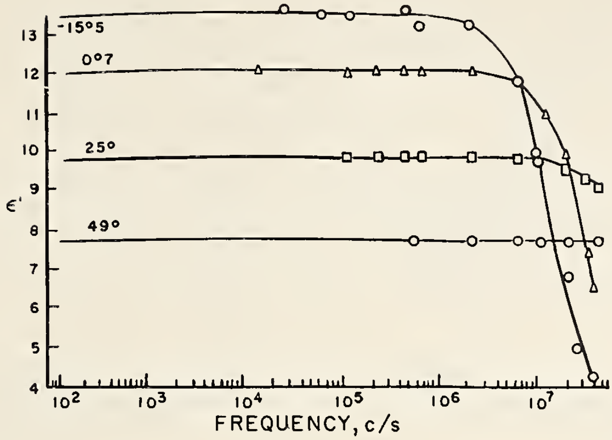


No. 124. $C_8H_{17}DO$, 1-Octanol-D-1. Corval (52).

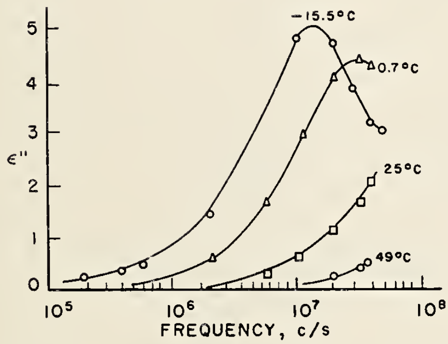


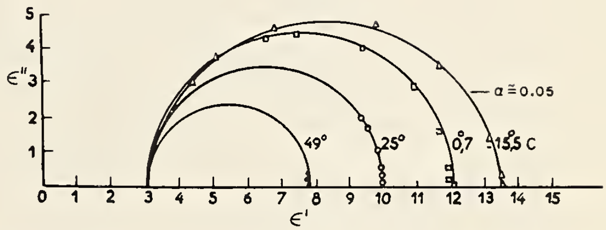
No. 125. $C_8H_{18}O$, 1-Octanol.

Girard (42). Cf. No. 70.

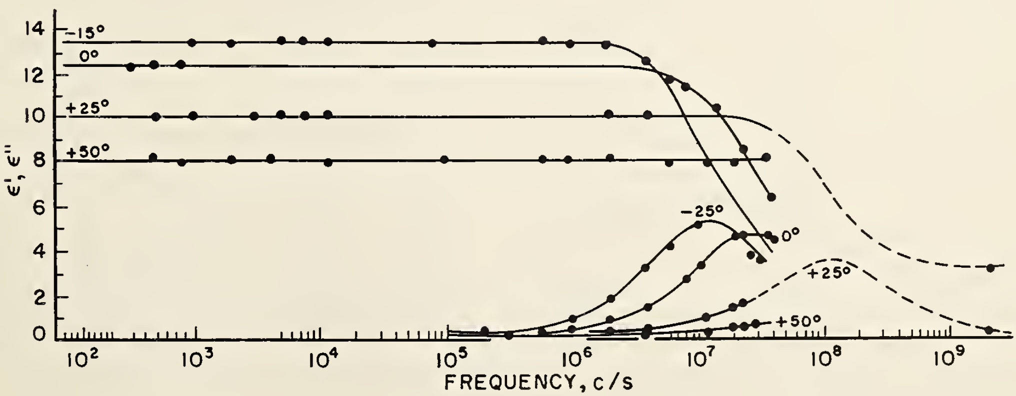


Dalbert (53). Cf. No. 67.

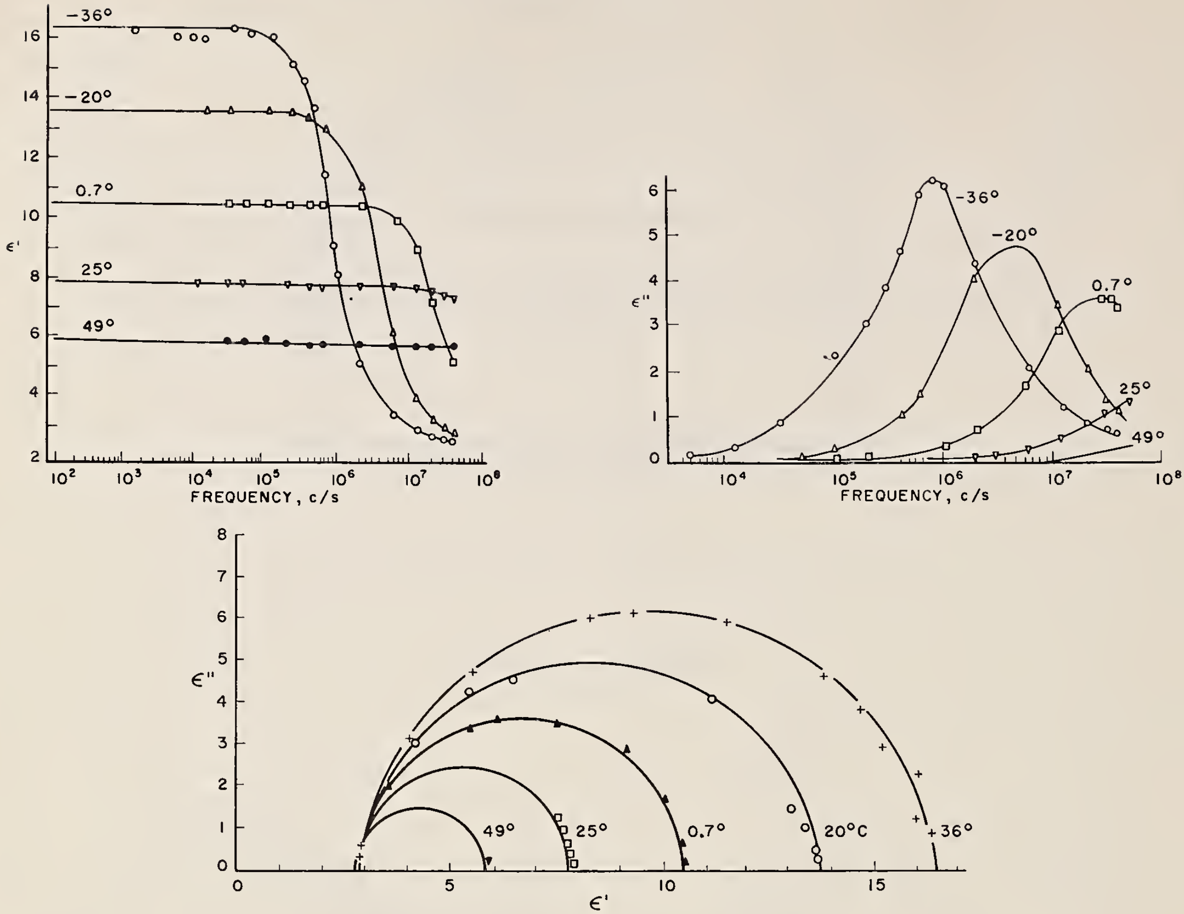




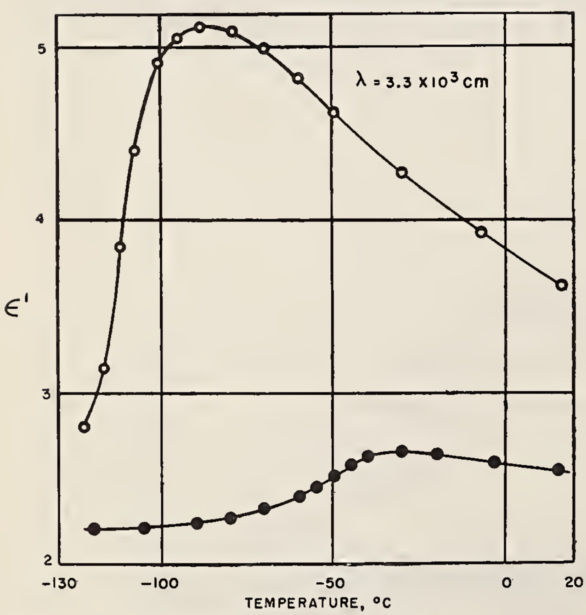
Dalbert (53).

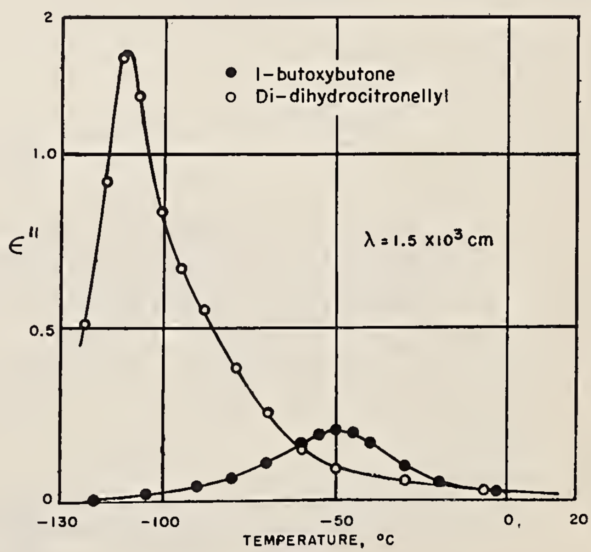


No. 126. $C_8H_{18}O$, 2-Octanol. Dalbert (53). Cf. No. 70.



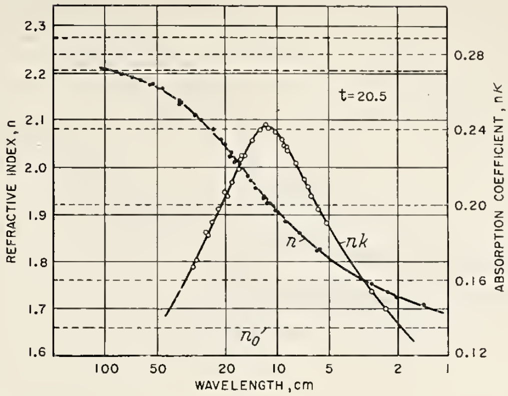
No. 127. $C_8H_{18}O$, Butyl ether. Schallamach (46.1).



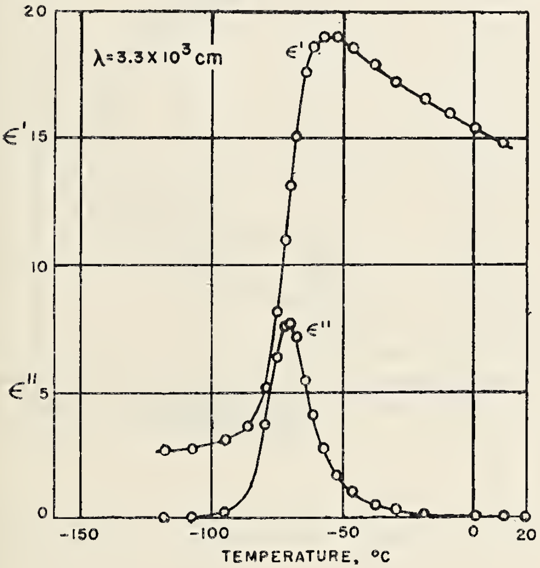


No. 131. $C_9H_{20}O$, 1-Nonanol. Cf. No. 93.

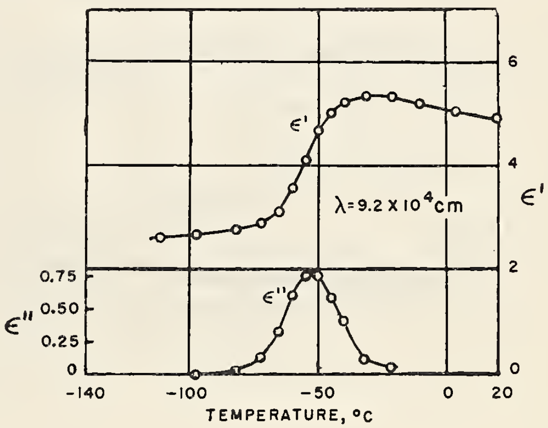
No. 132. $C_{10}H_7Br$, 1-Bromonaphthalene. Meckbach (52).



No. 136. $C_{10}H_{16}O$, Citral. Schallamach (46.1).

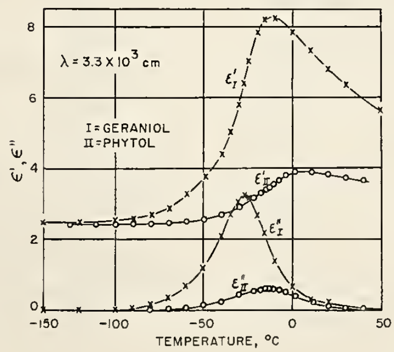


No. 137. $C_{10}H_{16}O_2$, Geranic acid. Schallamach (46.1).

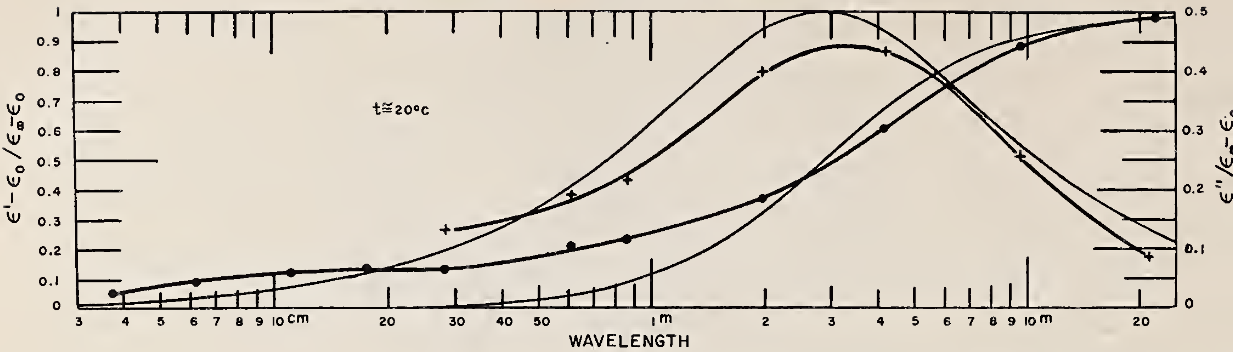


No. 138. $C_{10}H_{18}$, *trans*-Decahydronaphthalene. Cf. No. 80.

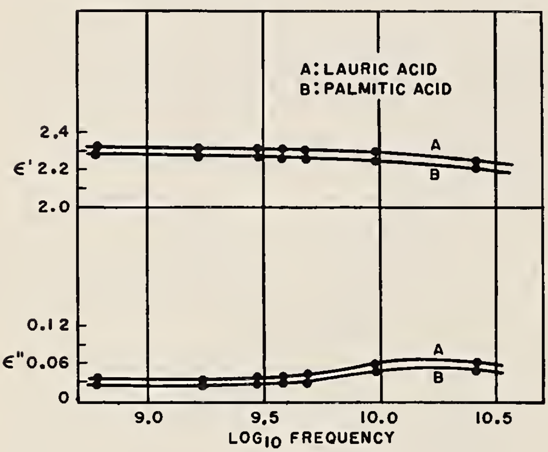
No. 139. $C_{10}H_{18}O$, Geraniol. Schallamach (46.2).



No. 142. $C_{10}H_{22}O$, 1-Decanol. Girard (45.1, 45.2). Cf. No. 93.

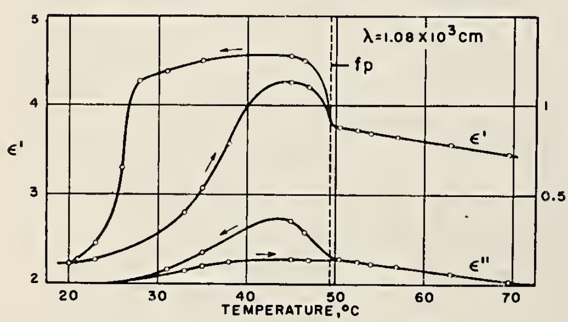


No. 150. $C_{12}H_{24}O_2$, Dodecanoic acid (Lauric). Buchanan (54).

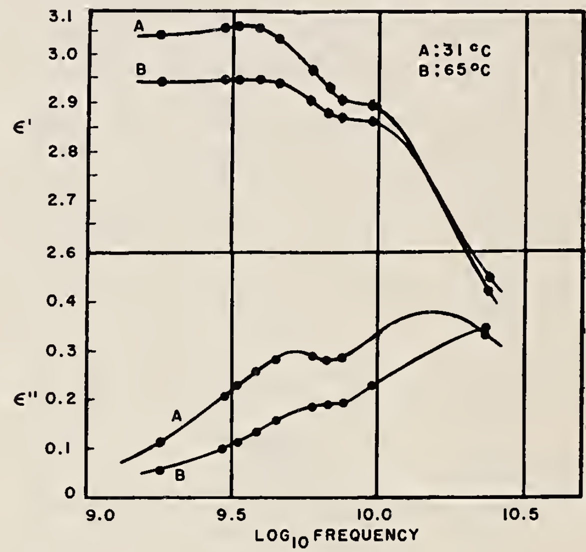


No. 153. $C_{12}H_{26}O$, 1-Dodecanol. Cf. No. 93.

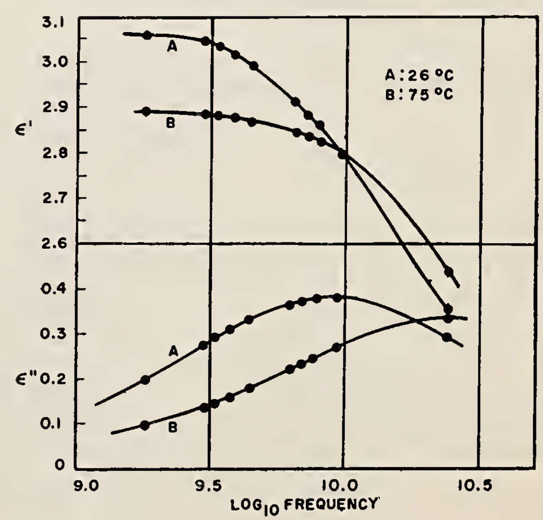
No. 163. $C_{16}H_{34}O$, 1-Hexadecanol. Klages (50).



No. 165. $C_{17}H_{34}O_2$, Methyl palmitate. Buchanan (54).



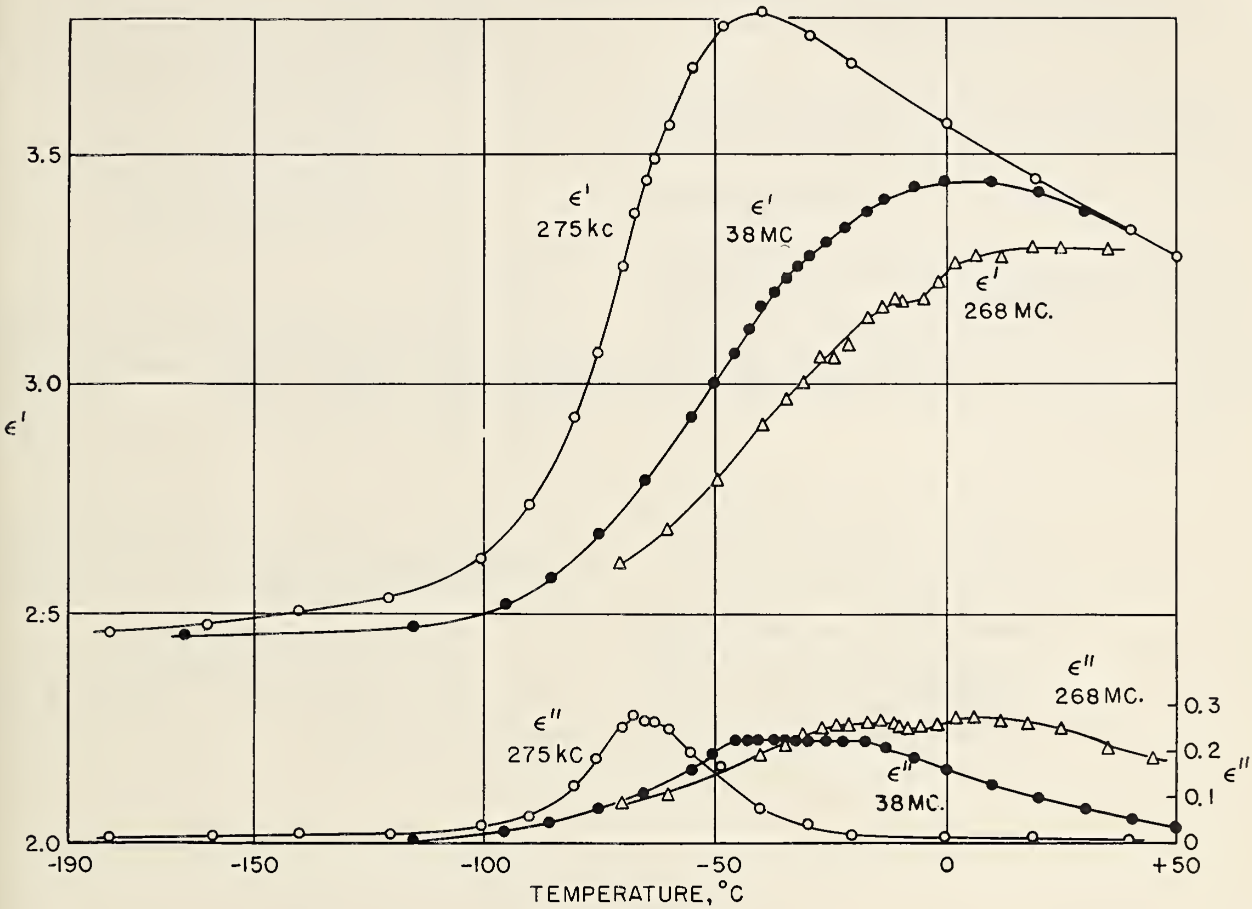
No. 169. $C_{18}H_{36}O_2$, Ethyl palmitate. Buchanan (54).



No. 172. $C_{20}H_{40}O$, Phytol. Cf. No. 139.

No. 174. $C_{20}H_{42}O$, Di-dihydrocitronellyl ether. Cf. No. 127.

No. 178. $C_{22}H_{42}O_2$, Phytyl acetate. Schallamach (46.2).



5. Dilute Solutions

Table 5. Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions

Table 6. Dielectric dispersion parameters and numerical data for dilute aqueous solutions

Chemical Formulas and Order of Listing of Compounds

The listing of solutes follows the scheme described for tables 1 to 4. The same scheme is adopted for the solvents under a given compound.

Dispersion Parameters for Nonaqueous Solutions

Treatment of data: The data for most solutions are either so limited or varied that a critical evaluation of the dispersion parameters is impractical. The values listed in tables 5 and 6 are in most instances those reported by the authors. They have been determined in the great majority of cases from Cole-Cole plots.

Tabulated quantities:

$(\Delta\epsilon/c)_\infty$ = the value of the incremental dielectric constant for $\lambda=\infty$.

$(\Delta\epsilon/c)_0$ = the value of the incremental dielectric constant for $\lambda=0$.

$\Delta\epsilon'/c$ = the incremental dielectric constant defined by the relation $\epsilon'_{12}=\epsilon'_1+(\Delta\epsilon'/c)\cdot c$, where c is the concentration, and the subscripts 12 and 1 refer to the solution and solvent, respectively.

$\Delta\epsilon''/c$ = the incremental dielectric loss defined by the relation $\epsilon''_{12}=(\Delta\epsilon''/c)\cdot c$.

$\Delta \tan \delta/c$ = the incremental loss tangent defined by the relation $\tan \delta_{12}=(\Delta \tan \delta/c)\cdot c$.

α = the distribution parameter of the Cole-Cole representation.

λ_c = the critical wavelength characteristic of the dispersion.

Notations:

$(\Delta\epsilon'/c)(\ )$, $(\Delta\epsilon''/c)(\ )$: The symbols m, x, and w in the parentheses following the data listed for $\Delta\epsilon'/c$ and $\Delta\epsilon''/c$ denote the concentration units, molarity, mole fraction, and weight fraction, respectively.

[ ]: Brackets denote that the value is assumed.

Dispersion Parameters for Aqueous Solutions

The quantities tabulated are the Debye parameters for the individual solutions.

References and Bibliography

All references are collected in a bibliography at the end of the tables.

Table 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan\delta}{c}$	α_{Cole}	λ_c (cm)	References
	C_1										
$CHCl_3$	Chloroform										
	Solvents: Carbon tetrachloride	23	430								49.1 Fischer.
		20	3.65					0.0157(m)	0	0.94	50.2 Whiffen.
			1.65					.030			
			1.41					.032			
			0.885					.034			
			.625					.031			
	Carbon disulfide	20	3.34					.0100(m)	0	.51	50.2 Whiffen.
			1.41					.025			
			0.885					.030			
			.625					.034			
	Benzene	23	430								49.1 Fischer.
		20	3.65					.023(m)	0	1.34	50.2 Whiffen.
			1.65					.034			
			1.41					.034			
			0.885					.032			
			.625					.030			
		19	1.22					.0326(m)			48 Powles.
			0.80					.0256			
		19	9.09					.0085(m)	0	1.45	46 Jackson.
			3.06					.0289			
			1.23					.0356			
	Cyclohexane	20	3.348					.0118	0	0.60	50.2 Whiffen.
			1.41					.029			
			0.885					.033			
			.625					.034			
	1-Heptane	−70	1.27					.041(m)	0	2.17	46.2 Whiffen.
		−60						.042		1.79	
		−50						.042		1.51	
		−40						.041		1.26	
		−30						.038		1.09	
		−20						.036		0.98	
		−10						.033		.83	
		0						.030		.72	
		10						.028		.68	
		20						.026		.64	
		40						.023		.58	
		60						.020		.51	
		80						.017		.45	
CH_2O_2	Formic acid										
	Solvent: 1,4-Dioxane	(20?)	25.6						[0]	3.2	48 Potopenko.
CH_3Br	Bromomethane										
	Solvent: Carbon tetrachloride	20	9.65					.082(w)	[0]	0.34	54 LeFevre.
CH_3Cl	Chloromethane										
	Solvent: Carbon tetrachloride	22	9.65					.192(w)	[0]	.34	54 LeFevre.
CH_3I	Iodomethane										
	Solvent: Carbon tetrachloride	22	9.65					.059(w)	[0]	.47	54 LeFevre.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan\delta}{c}$	α_{Cole}	λ_c(cm)	References	
	C_1—Continued											
CH_3NO_2	Nitromethane											
	Solvents: Carbon tetrachloride	22	9.65					0.84(w)	[0]	0.58	54	LeFevre.
		10 20 30 40	0.866					.207 .216 .219 .214	[0]	1.14	56	Clark.
	Benzene	19	3.26 1.27					.091(m) .196	[0]	0.74	46.1	Whiffen.
		18.5	3.25 1.25					.102(m) .197	0	.82	46	Cripwell.
		10 20 30 40	0.866					.231(m) .228 .211 .186	[0]	.80	56	Clark.
CH_4O	Methanol											
	Solvent: Benzene	23	430								49.1	Fischer.
		(20)	400 to 450								39	Fillipov.
		25	1.25; 3.20								55	Poley.
	C_2											
$C_2H_3Cl_3$	1,1,1-Trichloroethane											
	Solvents: Carbon tetrachloride	4	10.7 1.24	4.48	0.00	3.66(x) 2.54	0.18(x) 1.63		0.10	.86	56	Holland.
		20	30 10.7 1.24	3.58	−.09	3.60 3.62 2.66	0.09 .16 1.41		.07	.67		
		40	10.7 1.24	3.18	.00	3.18 2.68	0.13 1.29		.00	.58		
	1-Heptane	20	3.22 1.27	2.50	.19	2.4(x) 1.97	0.32(x) .76		.12	.45	52	Curtis.
		40	3.22 1.27	2.23	.19	2.12 1.85	.26 .63		.12	.40		
		60	3.22 1.27	1.99	.19	1.95 1.73	.20 .52		.11	.34		
	Paraffin	20	10.0 3.22 1.27	2.43	.04	2.25(w) 2.16 1.45	.23(w) .54 .90		.16	.83		
		40	10.0 3.22 1.27	2.18	.04	2.08(w) 1.98 1.38	.17(w) .42 .82		.17	.67		
		60	10.0 3.22 1.27	2.00	.04	1.92(w) 1.82 1.14	.15(w) .33 .74		.17	.56		
C_2H_3N	Acetonitrile											
	Solvents: Carbon tetrachloride	22	9.65					1.35(w)	[0]	.53	54	LeFevre.
	Benzene	18.5	3.25 1.25					0.0919(m) .213	[0]	.47	46	Cripwell.

$C_2H_4Cl_2$	1,2-Dichloroethane										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_2H_4Br_2$	1,2-Dibromoethane										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_2H_4O_2$	Acetic acid										
	Solvent: 1,4-Dioxane	(20?)	25.6						[0]	4.9	48 Potopenko.
C_2H_5Br	Bromoethane										
	Solvents: Benzene	0	3.22 1.27	5.40	−0.06	4.98(x) 3.35	1.47(x) 1.75		0.02		50 Franklin.
		20	3.22 1.27	5.20	−.06	4.68 3.40	1.06 1.54		.2	0.6	
		40	3.22 1.27	5.00	−.07	4.26 3.35	0.78 1.31		.2		
	Cyclohexane	0	3.22 1.27	4.50	.14	4.05(x) 2.85	0.80(x) 1.10		.2		
		20	3.22 1.27	4.30	.13	3.73 2.85	0.60 .95		.2	.4	
		40	3.22 1.27	4.10	.12	3.39 2.80	.45 .81		.2		
	1-Heptane	0	3.22 1.27	3.10	.15	3.08 3.10	.48(x) .78		.05		
		20	3.22 1.27	3.00	.14	2.76 2.80	.36 .66		.1	.3	
		40	3.22 1.27	(2.90)	.13	2.49 2.40	.27 .56		.26		
	Hexadecane	20	3.22 1.27	1.45	.04	1.37(x) 1.20	.28(x) .33		.2	.4	
		30	3.22 1.27	1.40	.04	1.29 1.08	.24 .29		.3		
		40	3.22 1.27	1.37	.04	1.24 0.95	.20 .25		.3		
C_2H_6O	Ethanol										
	Solvent: Benzeno	23	430								49.1 Fischer.
		(20)	400 to 450								39 Fillipov.
		21	1.25 to 3.99								55 Poley.
	C_3										
$C_3H_6Cl_2$	2,2-Dichloropropane										
	Solvents: 1-Heptane	2	30. 10.7 6.6 1.24	4.20	.04	4.20(x) 4.05 4.10 3.18	.07(x) .19 .33 1.22		.21	.48	56 Holland.
		20	30. 10.7 6.6 1.24	3.80	.04	3.79 3.68 3.70 2.90	0.05 .15 .22 1.05		.22	.45	
		40	30. 10.7 6.6 1.24	3.42	.05	3.42 3.30 3.30 2.82	0.04 .11 .17 .84		.20	.34	

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

Solution		t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References
	C₃—Continued										
$C_3H_6Cl_2$	2. 2 Dichloropropane—Con.										
	Solvents—Continued Nujol [a]	40	30. 10. 7 6. 6 3. 22 1. 24	3. 71	0. 17	3. 51(x) 3. 70 3. 68 3. 68 2. 78	0. 10 . 28 . 44 . 55 1. 22		0. 0	0. 51	
		60	30. 10. 7 6. 6 3. 22 1. 24	3. 14	. 17	3. 04 3. 17 3. 15 3. 02 2. 98	0. 07 . 22 . 31 . 34 1. 08		. 0	. 41	
C_3H_6O	Acetone										
	Solvents: Benzene	23	430								49. 1 Fischer.
		24	380								37 Holzmüller.
		19	9. 09 3. 06 1. 23					0. 0256(m) . 0854 . 170	0	. 625	46 Jackson.
		19	3. 26 1. 27					. 067(m) . 143	0	. 60	46. 1 Whiffen.
		18. 5	3. 25 1. 27					. 0778(m) . 168	0	. 63	46 Cripwell.
		19	1. 22					. 154(m)			48 Powles.
		(30)	3. 15								56. 1 Murty.
	1-Hexane	24	380								37 Holzmüller.
$C_3H_6N_2O_4$	2, 2–Dinitropropane										
	Solvents: 1-Heptane	2	30. 10. 7 6. 6 1. 24	11. 00	. 06	10. 9(x) 11. 4 10. 8 7. 9	0. 26(x) . 95 1. 44 4. 46		0. 06	. 73	56 Holland.
		20	30 10. 7 6. 6 3. 22 1. 24	10. 14	. 06	10. 2 10. 2 9. 9 9. 50 8. 2	0. 20 . 70 1. 05 2. 14 3. 69		. 04	. 56	
		40	30 10. 7 6. 6 1. 24	9. 11	. 06	9. 15 9. 10 9. 1 7. 9	0. 15 . 55 . 76 3. 15		. 00	. 50	
	Nujol [a]	20	30. 10. 7 6. 6 3. 22 1. 24	12. 13	−. 11	11. 7(x) 11. 2 11. 3 9. 6 5. 7	0. 62(x) 1. 78 2. 44 2. 84 4. 33		. 22	1. 35	
		40	30. 10. 7 6. 6 3. 22 1. 24	11. 34	−. 21	11. 1 11. 0 11. 0 9. 6 6. 2	0. 44 1. 27 1. 82 2. 22 4. 10		. 21	1. 06	
		60	30. 10. 7 6. 6 3. 22 1. 24	10. 27	−. 14	10. 4 10. 2 9. 8 9. 0 6. 7	0. 32 . 97 1. 26 1. 44 3. 81		. 17	0. 78	

$C_3H_6O_2$	Propionic acid											
	Solvent: 1,4-Dioxane	(20?)	25.6						[0]	5.4	48	Potopenko.
	Methyl acetate											
	Solvent: Benzene	18.5	3.25 1.25					.0291 (m) .0602	0	0.70	46	Cripwell.
		19.	3.26 1.27					.026 (m) .057	0	.58	46.1	Whiffen.
C_3H_7Br	1-Bromopropane											
	Solvent: Benzene	23	430								49.1	Fischer.
C_3H_7Cl	1-Chloropropane											
	Solvent: Benzene	23	430								49.1	Fischer.
C_3H_8O	1-Propanol											
	Solvent: Benzene	23 (20) 24	430 400 to 450 382								49.1 39 36	Fischer. Fillipov. Martin.
	C_4											
$C_4H_6O_3$	Acetic anhydride											
	Solvents: 1,4-Dioxane	20	22.4			17.3(x)	(6)(x)		[0]	(9)	54	Ekelund.
	1-Pentane	20	22.4			9.80(x)	1.7(x)		[0]	(4)	54	Ekelund.
	Benzene	20	22.4	14.3		14.8(x)	(4)(x)		[0]	(6)	54	Ekelund.
	1-Hexane	20	22.4			7.94(x)	1.7(x)		[0]	(5)	54	Ekelund.
$C_4H_8O_2$	*n*-Butyric acid											
	Solvent: 1,4-Dioxane	(20?)	25.6						[0]	6.6	48	Potopenko.
C_4H_9Br	2-Bromo-2-methylpropane											
	Solvent: Carbon tetrachloride	20	9.65					.226(w)	[0]	0.71	54	LeFevre.
C_4H_9Cl	2-Chloro-2-methylpropane											
	Solvents: Carbon tetrachloride	4	10.0 3.22	--------	−0.19	6.20(x) 5.96	0.27(x) 1.40		0.02	.70	52	Curtis.
		20	10.0 3.22 1.27	5.75	−.19	5.81 5.42 4.17	0.23 1.16 2.60		.02	.65		
		40	10.0 3.22 1.27	5.11	−.19	5.09 4.93 3.89	0.17 .86 2.08		.04	.60		
		24	9.65					.253(w)	[0]	.57	54	LeFevre.
	Cyclohexane	20	5.59 3.22 1.27	5.00	.16	4.82(x) 4.78 3.90	0.42(x) .74 1.26		0.2	.3	50	Franklin.
		30	5.59 3.22 1.27	4.80	.16	4.54 4.48 3.90	0.37 .66 1.12		.3	----------		
		40	5.59 3.22 1.27	4.65	.16	4.26 4.08 3.85	0.31 .57 .97		.3	----------		

[a] Purified mineral oil.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References	
	C_4—Continued											
C_4H_9Cl	2-Chloro-2-methylpropane—Continued											
	Solvents—Continued 1-Heptane	0	5.59 3.22 1.27	4.00	0.22	3.70(x) 3.74 3.45	0.34(x) .56 .93		0.3	----------	50	Franklin.
		20	5.59 3.22 1.27	3.56	.20	3.50 3.50 2.90	.26 .45 .75		.2	0.3		
		40	5.59 3.22 1.27	3.26	.19	3.28 3.10 2.45	.19 .34 .64		.2	----------		
	Hexadecane	20	3.22 1.27	1.85	.06	1.64(x) 1.70	.27(x) .50				50	Franklin.
		30	3.22 1.27	1.80	.06	1.54 1.60	.24 .43					
		40	3.22 1.27	1.70	.05	1.46 1.55	.22 .36					
C_4H_9I	2-Iodo-2-methylpropane											
	Solvent: Carbon tetrachloride	20	9.65					0.214(w)	[0]	0.94	54	LeFevre.
$C_4H_{10}O$	1-Butanol											
	Solvent: Benzene	(20)	400 to 450								39	Fillipov.
	2-Methyl-1-propanol											
	Solvent: Benzene	20	10 to 500						[0]	(6)	46	Häfelin.
	C_5											
C_5H_5N	Pyridine											
	Solvents: Carbon tetrachloride	25	340								53	Hase.
	I, 4-Dioxane	25	340								53	Hase.
	Benzene	25	340								53	Hase.
	Cyclohexane	25	340								53	Hase.
	1-Hexane	25	340								53	Hase.
	1-Heptane	1	33.3 10.7 6.6 1.24	4.08	.20	4.08(x) 4.10 3.90 3.50	0.06(x) .19 .35 1.26		0.05	0.46	55.1	Holland.
		20	33.3 10.7 6.6 1.24	3.67	.17	3.68(x) 3.70 3.66 3.26	0.05(x) .15 .25 1.06		.04	.42		
		40	33.3 10.7 6.6 1.24	3.37	.17	3.38(x) 3.40 3.32 3.00	0.04(x) .11 .17 .86		.06	.36		
C_5H_8O	Cyclopentanone											
	Solvents: Benzene	24.1	380								37	Holzmüller.
	1-Hexane	24.1	380								37	Holzmüller.

	2-Pentanone											
	Solvents: Benzene	24.1	380								37	Holzmüller.
	1-Hexane	24.1	380								37	Holzmüller.
	3-Pentanone											
	Solvents: Benzene	23	430								49.1	Fischer.
		24.1	380								37	Holzmüller.
	1-Hexane	24.1	380								37	Holzmüller.
	C_6											
$C_6H_3FN_2O_4$	1-Fluoro-2,4-dinitrobenzene											
	Solvent: Benzene	30	3.15	7.47	.256	3.50	(2.4)		(0.3)	(4)	56	Rao.
$C_6H_4Br_2$	*o*-Dibromobenzene											
	Solvent: Benzene	23	430								49.1	Fischer.
$C_6H_4Cl_2$	*o*-Dichlorobenzene											
	Solvents: Carbon tetrachloride	24	382								36	Martin.
	Benzene	23	430								49.1	Fischer.
		24	382								36	Martin.
	1-Hexane	24	382								36	Martin.
	Decalin	24	382								36	Martin.
$C_6H_4ClNO_2$	1-Chloro-4-nitrobenzene											
	Solvent: Carbon tetrachloride	20	9.65					1.40(w)	[0]	4.7	54	LeFevre.
C_6H_5Br	Bromobenzene											
	Solvents: Carbon tetrachloride	23	430								49.1	Fischer.
		24	9.65					0.285(w)	[0]	2.26	54	LeFevre.
	Benzene	19	48.5 25.2 9.09 3.06 1.23					.0071(m) .0112 .0239 .0724 .0663	0	1.98	46	Jackson.
		20	3.65 1.65 0.885 .625					.053(m) .061 .044 .038	0	2.00	50.2	Whiffen.
		19	3.26 1.27					.054 .058	0	1.89	46.1	Whiffen.
		19	1.22					.0599(m)			48	Powles.
		19	10 to 49								46	Dunsmuir.
		30	3.15								56.2	Murty.
	Cyclohexane	20	1.65 0.885 .625					.062(m) .047 .039	0	1.96	50.2	Whiffen.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

Formula	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References
	C_6—Continued										
C_6H_5Cl	Chlorobenzene										
	Solvents: Carbon tetrachloride	25	450								53.1 Fischer.
		25	340								53 Hase.
		14	0.65					0.33(w)	[0]	1.62	54 LeFevre.
	1,4-Dioxane	25	340								53 Hase.
	Benzene	23	430								49.1; 49.2 Fischer.
		25	340								53 Hase.
		30	3.15								56.2 Murty.
		20	3.65 1.65 1.41 0.885 .625					.048(m) .063 .061 .054 .045	0	1.56	50.2 Whiffen.
		19	3.26 1.27					.046(m) .063	0	1.41	46.1 Whiffen.
		18.5	3.25 1.25					.056(m) .0563	0	2.05	46 Cripwell.
	Cyclohexane	25	340								53 Hase.
		19	1.65 0.885 .625					.064(m) .055 .051	0	1.47	50.2 Whiffen.
	1-Hexane	25	340								53 Hase.
C_6H_5ClO	*o*-Chlorophenol										
	Solvent: Carbon tetrachloride	25;42	454								54 Fischer.
C_6H_5F	Fluorobenzene										
	Solvent: Benzene	14	9.65					.203 (w)	[0]	1.02	54 LeFevre.
		30	3.15								56.2 Murty.
C_6H_5I	Iodobenzene										
	Solvents: Carbon tetrachloride	14	9.65					.23(w)	[0]	2.83	54 LeFevre.
	1,4-Dioxane	25	340								53 Hase.
	Benzene	25	340								53 Hase.
		30	3.15								56.2 Murty.
	Cyclohexane	25	340								53 Hase.
	1-Hexane	25	340								53 Hase.
$C_6H_5NO_2$	Nitrobenzene										
	Solvents: Carbon tetrachloride	25;42	5.32								53.2 Fischer.
		25	340								53 Hase.

		20	3.65 1.65 1.41 0.885 .625					.388(m) .337 .289 .220 .177	0	2.87	50.2 Whiffen.
	Carbon disulfide	20	3.65 1.65 1.41 0.885 .625					.290(m) .412 .389 .312 .270	0	1.62	50.2 Whiffen.
	1,4-Dioxane	25	340								53 Hase.
	Benzene	23	430								49.1 Fischer.
		25	340								53 Hase.
		19	48.5 25.2 9.09 3.06 1.23					.0350(m) .0883 .1736 .440 .367	0	2.18	46 Jackson.
		20	10.2 3.26 1.25					.184(m) .419 .400	0	2.15	55 Hartshorn.
		20	1.25 to 3.99								55 Poley.
		20	3.65 1.65 0.885 .625					.375(m) .399 .269 .217	0	2.41	50.2 Whiffen.
		19	3.26 1.27					.358(m) .332	0	2.17	46.1 Whiffen.
		18.5	3.25 1.25					.414 .347	0	2.45	46 Cripwell.
		20	9.65					1.30(w)	[0]	2.07	54 LeFevre.
		(30)	3.15								56.1 Murty.
	Cyclohexane	25	340								53 Hase.
		20	3.65 1.65 1.41 0.885 .625					0.338(m) .408 .386 .330 .279	0	1.79	50.2 Whiffen.
	1-Hexane	25	340								53 Hase.
	1-Heptane	20	3.65 1.65 1.41 0.885 .625					.262(m) .409 .417 .378 .335	0	1.28	50.2 Whiffen.
$C_6H_5NO_3$	*o*-Nitrophenol										
	Solvent: Carbon tetrachloride	25	454								54 Fischer.
C_6H_6O	Phenol										
	Solvent: Carbon tetrachloride	25; 42	454								53.1 Fischer.
C_6H_7N	Aniline										
	Solvents: Carbon tetrachloride	25; 42	460								53.2 Fischer.
	Benzene	23	430								49.1 Fischer.
$C_6H_8N_2$	1,4-Benzene diamine										
	Solvent: Benzene	23	430								49.1 Fischer.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

Solution		t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References
	C_6—Continued										
$C_6H_{10}O$	Cyclohexanone										
	Solvents: Carbon tetrachloride	25	473						[0]	1.64	56 Dieringer.
	Benzene	24.1	380								37 Holzmüller.
		19	3.26 1.27					0.165(m) .251	0	1.23	46.1 Whiffen.
		18.5	3.25 1.25					.215(m) .220	0	1.98	46 Cripwell.
	Cyclohexane	25	473						[0]	0.83	56 Dieringer.
	1-Hexane	24.1	380								37 Holzmüller.
$C_6H_{11}Br$	Bromocyclohexane										
	Solvent: Carbon tetrachloride	25	473						[0]	2.6	56 Dieringer.
$C_6H_{11}Cl$	Chlorocyclohexane										
	Solvent: Carhon tetrachloride	25	473						[0]	2.0	56 Dieringer.
		25	340								53 Hase.
	1,4-Dioxane	25	340								53 Hase.
	Benzene	25	340								53 Hase.
	Cyclohexane	25	340								53 Hase.
	1-Hexane	25	340								53 Hase.
$C_6H_{11}NO_2$	Nitrocyclohexane										
	Solvents: Carhon tetrachloride	25	473						[0]	2.73	56 Dieringer.
	Cyclohexane	25	473						[0]	1.56	56 Dieringer.
$C_6H_{12}O$	3,3-Dimethyl-2-Butanone (Pinacolin)										
	Solvents: Benzene	24.1	380								37 Holzmüller.
	1-Hexane	24.1	380								37 Holzmüller.
$C_6H_{12}O_3$	Paraldehyde										
	Solvent: Benzene	(22)	10; 25								50 LeFevre.
$C_6H_{14}O$	1-Hexanol										
	Solvent: Benzene	23	430								49.1 Fischer.
		24	382								36 Martin.
	C_7										
C_7H_5N	Benzonitrile										
	Solvents: Carhon tetrachloride	25;42 14	476 9.65					 4.25(w)	 [0]	 3.20	53.2 Fischer. 54 LeFevre.

	Benzene	23	430							49.1	Fischer.
C_7H_6O	Benzaldehyde										
	Solvent: Benzene	23	430							49.1	Fischer.
$C_7H_6O_2$	Salicylaldehyde										
	Solvent: Carbon tetrachloride	25	454							54	Fischer.
C_7H_7Cl	α-Chlorotoluene (benzyl chloride)										
	Solvent: Benzene	23	430							49.1	Fischer.
C_7H_7I	*p*-Iodotoluene										
	Solvents: Carbon tetrachloride	25	340							53	Hase.
	1,4-Dioxane	25	340							53	Hase.
	Benzene	25	340							53	Hase.
	Cyclohexane	25	340							53	Hase.
	1-Hexane	25	340							53	Hase.
$C_7H_7NO_2$	*p*-Nitrotoluene										
	Solvent: Benzene	22	9.65					2.31(w)	[0]	3.6	54	LeFevre.
C_7H_8	Toluene										
	Solvents: Carbon tetrachloride	22	9.65					0.015(w)	[0]	1.26	54	LeFevre.
	Toluene	19	3.26 1.27					.00175(m) .0024	0	1.38	46.1	Whiffen.
C_7H_8O	Methoxybenzene (Anisole)										
	Solvents: Carbon tetrachloride	25; 42	458							53.2	Fischer.
		25	340							53	Hase.
	Benzene	23	430							49.1	Fischer.
	o-Cresol										
	Solvent: Carbon tetrachloride	25	454							54	Fischer.
$C_7H_8O_2$	*o*-Methoxyphenol (Guaiacol)										
	Solvent: Carbon tetrachloride	25	447							54	Fischer.
C_7H_9N	Benzylamine										
	Solvents: Benzene	23	430							49.1	Fischer.
	o-Toluidine										
	Solvent: Benzene	23	430							49.1	Fischer.
	m-Toluidine										
	Solvent: Benzene	23	430							49.1	Fischer.
	p-Toluidine										
	Solvent: Benzene	23	430							49.1	Fischer.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References
	C_7—Continued										
$C_7H_{14}O$	4-Heptanone										
	Solvent: Benzene	23	430								49.1 Fischer.
		24.1	380								37 Holzmüller.
	2,4-Dimethyl-3-pentanone										
	Solvents: Benzene	24.1	380								37 Holzmüller.
	1-Hexane	24.1	380								37 Holzmüller.
	Heptanal										
	Solvents: Benzene	24.1	380								37 Holzmüller.
	1-Hexane	24.1	380								37 Holzmüller.
$C_7H_{15}Br$	1-Bromoheptane										
	Solvent: Benzene	23	430								49.1 Fischer.
	C_8										
$C_8H_8Br_2$	*p*-Xylene dihromide										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_8H_8Cl_2$	*p*-Xylene dichloride										
	Solvent:										
	Benzene	23	430								49.1 Fischer.
C_8H_8O	Acetophenone										
	Solvents: Carhon tetrachloride	25; 42	489								53.2 Fischer.
	Benzene	23	430								49.1 Fischer.
		(30)	3.15								56.1 Murty.
$C_8H_8O_2$	Phenyl acetate										
	Solvent: Benzene	23	430								49.1 Fischer.
	Methyl henzoate										
	Solvents: Benzene	20	3.65 1.65 1.41 0.885 .625					0.077(m) .086 .078 .060 .048	0	2.15	50.2 Whiffen.
		19	3.26 1.27					.074(m) .067	0	2.26	46.1 Whiffen.
		18.5	3.25 1.25					.0919(m) .0781	0	2.45	46 Cripwell.
	Cyclohexane	20	3.65 1.65 1.41 0.885 .625					.072(m) .077 .067 .055 .044	0	2.24	50.2 Whiffen.

	1-Heptane	−40 −30 −20 −10 0 10 20 40 60 80	1.27					.063(m) .068 .072 .076 .078 .079 .077 .073 .068 .062	0	3.58 3.02 2.54 2.17 1.70 1.53 1.41 1.26 1.13 0.96	46.2	Whiffen.
	1-Hydroxy-2-acetophenone											
	Solvent: Carbon tetrachloride	25	486								54	Fischer.
$C_8H_8O_3$	Methylsalicylate											
	Solvent: Carbon tetrachloride	25	454								54	Fischer.
C_8H_9Cl	2-Chloroethylbenzene											
	Solvent: Benzene	23	430								49.1	Fischer.
C_8H_{10}	*o*-Xylene											
	Solvent: Carbon tetrachloride	14	9.65					.041 (w)	[0]	1.70	54	LeFevre.
	m-Xylene											
	Solvent: Carbon tetrachloride	14	9.65					.012 (w)	[0]	2.07	54	LeFevre.
$C_8H_{10}O_2$	1,4-Dimethoxybenzene											
	Solvent: Carbon tetrachloride	25	340								53	Hase.
	1,3-Dimethoxybenzene											
	Solvent: Carbon tetrachloride	25	340								53	Hase.
	1,2-Dimethoxybenzene											
	Solvent: Carbon tetrachloride	25	340								53	Hase.
$C_8H_{17}Br$	1-Bromooctane											
	Solvents: Cyclohexane	0	5.59 3.22	--------	0.33	3.54 (x) 1.82	1.19 (x) 1.29		0.28	----------	50	Franklin.
		20	5.59 3.22 1.27	4.20	.30	3.14 2.04 1.40	1.10 1.21 1.02		.29	3.14		
		40	5.59 3.22 1.27	3.90	.30	2.76 2.23 1.60	1.01 1.10 1.06		.29	2.58		
		60	1.27	3.60	----------	1.80	1.01		------	----------		
	1-Heptane	0	10.0 5.59 3.22	3.44 [b]	.34	2.80 (x) 1.97 1.00	0.80 (x) 1.04 0.70		.26	2.88		
		20	10.0 5.59 3.22 1.27	3.14 [b]	.33	2.80 2.68 1.96 1.20	.63 .72 .92 .73		.24	2.07		
		40	10.0 5.59 3.22 1.27	2.89 [b]	.32	2.70 2.54 1.99 1.40	.50 .62 .81 .76		.24	1.82		

[b] Henrion, Bull. soc. roy. sci. Liège 8, 37 (1939).

Table 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References
	C_8—Continued										
	1-Heptane—Continued										
	Solvents—Continued	60	10.0 5.59 3.22 1.27	2.66 [b]	0.30	2.65 2.44 1.96 1.60	0.38 .53 .72 .73		0.16	1.39	
	1-Hexadecane	20	5.59 3.22 1.27	1.50	.10	1.04 (x) 0.73 .35	.41 (x) .20 .27		.30	3.64	
		40	5.59 3.22 1.27	1.40	.10	1.00 0.78 .40	.36 .37 .33		.39	3.00	
		60	5.59 3.22 1.27	1.30	.10	.96 .79 .44	.32 .35 .36		.29	2.55	
$C_8H_{17}Cl$	1-Chlorooctane										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_8H_{18}O$	1-Octanol										
	Solvent: Benzene	23	430								49.1 Fischer.
		24	382								36 Martin.
	Butyl ether										
	Solvent: Benzene	23									49.3 Fischer.
$C_8H_{19}N$	Dibutylamine										
	Solvent: Benzene	23									49.3 Fischer.
	C_9										
$C_9H_{10}O_2$	Ethyl benzoate										
	Solvents: Benzene	23	430								49.1 Fischer.
		20	3.65 1.65 0.885 .625					0.088(m) .085 .057 .046	0	2.43	50.2 Whiffen.
		19	3.26 1.27					.089(m) .078	0	2.26	46.1 Whiffen.
		18.5	3.25 1.25					.115(m) .077	0	3.32	46 Cripwell.
	Cyclohexane	20	3.65 1.65 1.41 0.885 .625					.082(m) .074 .065 .053 .043	0	2.60	50.2 Whiffen.
$C_9H_{11}Cl$	3-Chloropropylbenzene										
	Solvent: Benzene	23	430								49.1 Fischer.

$C_9H_{18}O$	5-Nonanone											
	Solvent: Benzene	23	430								49.1	Fischer.
	C_{10}											
$C_{10}H_7Br$	1-Bromonaphthalene											
	Solvents: Carbon tetrachloride	12	9.65					.31(w)	[0]	4.0	54	LeFevre.
	Benzene	23	430								49.1	Fischer.
	1-Heptane	20	10.0 3.22 1.27	2.35	.69	2.20(x) 1.78 0.90	.36(x) .85 .59		0.00	2.69	50	Franklin.
		20	3.26 1.65 1.27 0.88 .60					.0638(m) .0614 .0535 .0434 .0304	0	2.45	48	Whiffen.
		−70 −60 −50 −40 −30 −20 −10 0 10 20 40 60 80	1.27					.023(m) .027 .031 .035 .039 .042 .046 .048 .051 .053 .055 .057 .059	0	11.3 9.61 7.92 6.41 5.28 4.71 4.15 3.77 3.39 3.02 2.54 2.17 ----------	46.2	Whiffen.
	2-Bromonaphthalene											
	Solvent: Carbon tetrachloride	14	9.65					.37(w)	[0]	4.0	54	LeFevre.
$C_{10}H_7Cl$	1-Chloronaphthalene											
	Solvents: Carbon tetrachloride	14	9.65					.34(w)	[0]	3.4	54	LeFevre.
	Benzene	23	430								49.1	Fischer.
	1-Heptane	20	10.0 3.22 1.27	2.48	.65	2.42(x) 1.90 1.20	.38(x) .78 .71		0.07	2.0	52	Curtis.
		40	10.0 3.22 1.27	2.31	.65	2.29 1.90 1.26	.28 .66 .71		.04	1.7		
		60	10.0 3.22 1.27	2.13	.65	2.12 1.90 1.34	.22 .55 .71		.2	1.35		
	Paraffin	2.5	10.0 3.22 1.27	1.98	.37	0.91(x) .55 .51	.44(x) .26 .17		.31	21		
		20	10.0 3.22 1.27	1.88	.37	1.05 0.63 .53	.51 .32 .23		.25	12		
		40	10.0 3.22 1.27	1.77	.37	1.19 0.71 .53	.50 .38 .26		.22	7.4		
		60	10.0 3.22 1.27	1.65	.37	1.33 0.78 .55	.43 .43 .30		.16	5.0		

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan \delta}{c}$	α_{Cole}	λ_c(cm)	References	
	C_{10}—Continued											
	2-Chloronaphthalene											
	Solvent: Carhon tetrachloride	12	9.65					0.50(w)	[0]	3.8	54	LeFevre.
$C_{10}H_7F$	1-Fluoronaphthalene											
	Solvent: Carhon tetrachlorlde	14	9.65					.30(w)	[0]	2.8	54	LeFevre.
	2-Fluoronaphthalene											
	Solvent: Carhon tetrachloride	15	9.65					.40(w)	[0]	3.4	54	LeFevre.
$C_{10}H_7I$	1-Iodonaphthalene											
	Solvent: Carhon tetrachloride	12	9.65					.232(w)	[0]	4.4	54	LeFevre.
	2-Iodonaphthalene											
	Solvent: Carhon tetrachlorlde	12	9.65					.30(w)	[0]	5.1	54	LeFevre.
$C_{10}H_7NO_2$	1-Nitronaphthalene											
	Solvents: Carhon tetrachlorlde	20	9.65					2.52(w)	[0]	3.6	54	LeFevre.
	Benzene	15	9.65					1.28(w)	[0]	3.2		
$C_{10}H_9N$	1-Naphthylamine											
	Solvent: Benzene	23	430								49.1	Fischer.
$C_{10}H_{12}O_2$	4-Allyl-1-hydroxy-2-methoxyhenzene (Eugenol).											
	Solvent: Carhon tetrachlorlde	25	455								54	Fischer.
$C_{10}H_{16}O$	Camphor											
	Solvents: Carbon tetrachlorlde	20	3.34 1.65 1.41 0.885 .625					0.211(m) .235 .212 .178 .130	0	2.02	50.2	Whiffen.
	Carbon disulfide	20	3.34 1.65 1.41 0.885 .625					.159(m) .226 .219 .202 .163	0	1.41		
	Tetrachloroethylene	20	3.34 1.65 1.41 0.885 .625					.190(m) .219 .183 .159 .120	0	2.02		
	Methyl cyclopentane	20	3.34 1.41 0.885 .625					.131(m) .245 .237 .198	0	1.09		

	Benzene	20	3.34 1.65 1.41 0.885 .625					.192(m) .228 .212 .190 .142	0	1.79		
		15	9.65					.52(w)	[0]	1.83	54	LeFevre.
	Cyclohexane	20	3.65 1.65 1.41 0.885 .625					.161(m) .230 .232 .213 .189	0	1.34	50.2	Whiffen.
		12 25 37 51 66	10.0					.064(m) .056 .047 .037 .030	0	[c]1.39(10°) 1.17(30°) 1.00(50°) 0.85(70°)	48	Whiffen.
		10 32 46 64	3.3					.194(m) .156 .135 .118				
		10 29 46 62	1.3					.246(m) .226 .235 .202				
		21	5.59 3.22 1.27	9.70[d]	0.21	8.66(x) 7.70 4.03	1.88(x) 3.29 3.53		0.14	1.72	50	Franklin.
	1-Heptane	20	3.26 1.65 1.27 0.88 .60					.165(m) .235 .242 .240 .193	0	1.23	48	Whiffen.
		−70 −60 −50 −40 −30 −20 −10 0 10 20 40 60 80	1.27					.171(m) .193 .212 .224 .235 .240 .248 .250 .246 .242 .224 .204 .181	0	4.71 3.96 3.30 2.92 2.54 2.26 2.07 1.70 1.51 1.32 1.06 0.91 .77	46.2	Whiffen.
$C_{10}H_{21}Cl$	1-Chlorodecane											
	Solvent: Benzene	23	430								49.1	Fischer.
$C_{10}H_{22}O$	1-Decanol											
	Solvents: Carbon tetrachloride	20 to 40	1.25 to 10.0								56.1	Rathmann.
	Nujol[a]	20 to 60	1.25 to 10.0									
	C_{11}											
$C_{11}H_{22}O$	2-Undecanone											
	Solvents: Benzene	24.1	380								37	Holzmüller.
	1-Hexane	24.1	380								37	Holzmüller.

[a] Purified mineral oil.
[c] From interpolated data.
[d] Calculated from the dilute solution approximation of the Debye equation with μ=3.00D.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan\delta}{c}$	α_{Cole}	λ_c(cm)	References	
	C_{11}—Continued											
	6-Undecanone											
	Solvents: Benzene	24.1	380								37	Holzmüller.
	1-Hexane	24.1	380								37	Holzmüller.
	C_{12}											
$C_{12}H_9Cl$	4-Chlorobiphenyl											
	Solvent: Benzene	22	9.65					0.26(w)	[0]	6.0	54	LeFevre.
$C_{12}H_9I$	Iodobiphenyl											
	Solvents: Carbon tetrachloride	25	340								53	Hase.
	1,4-Dioxane	25	340								53	Hase.
	Benzene	25	340								53	Hase.
	Cyclohexane	25	340								53	Hase.
	1-Hexane	25	340								53	Hase.
$C_{12}H_9NO_2$	4-Nitrobiphenyl											
	Solvent: Benzene	22	9.65					1.97(w)	[0]	6.6	54	LeFevre.
$C_{12}H_{10}O$	Phenyl ether											
	Solvent: Benzene	23									49.3	Fischer.
$C_{12}H_{11}N$	Diphenylamine											
	Solvent: Benzene	23									49.3	Fischer.
$C_{12}H_{12}N_2$	4,4′-Diaminobiphenyl											
	Solvent: Benzene	23	430								49.1	Fischer.
$C_{12}H_{25}Cl$	1-Chlorododecane											
	Solvents: Carbon tetrachloride	25	340								53	Hase.
	1,4-Dioxane	25	340								53	Hase.
	Benzene	23	430								49.1	Fischer.
		25	340								53	Hase.
	Cyclohexane	25	340								53	Hase.
	n-Hexane	25	340								53	Hase.
	C_{13}											
$C_{13}H_{10}O$	Benzophenone											
	Solvents: Carbon tetrachloride	10 20 30	3.25					0.219(m) .225 .217			56	Clark.

		−10 18 44	(1.2 to 34) (0.86 to 220) (1.2 to 17)						[0] [0] [0]	7.0 5.8 5.0	56	Fairweather.
	Benzene	24.1	380								37	Holzmüller.
		23	(450?)								49.3	Fischer.
		19	375 48.5 25.2 9.09 3.06 1.23					.007(m) .0332 .0720 .144 .264 .176	0	3.10	46	Jackson.
		19	3.26 1.27					.219(m) .129	0	4.15	46.1	Whiffen.
		18.5	3.25 1.25					.225(m) .143	0	3.41	46	Cripwell.
		20	1.65 1.41 0.885 .625					.197(m) .157 .114 .084	0	3.28	50.2	Whiffen.
		19	1.22 0.80					.151(m) .0983			48	Powles.
		10 15 20 25 30	3.25					.250(m) .250 .243 .235 .227	 [0]	 3.0	56	Clark.
		18	(0.86 to 34)						[0]	4.1	56	Fairweather.
		(30)	3.15								56.1	Murty.
	Cyclohexane	20	3.65 1.65 1.41 0.885 .625					.216(m) .163 .137 .105 .080	0	3.36	50.2	Whiffen.
	1-Hexane	24.1	380								37	Holzmüller.
		18	(0.86 to 10)						[0]	2.7	56	Fairweather.
	1-Heptane	20	10.0 3.22 1.25	7.09	0.90	6.60 4.7 2.06	1.60 3.04 2.16		0	2.7	56.2	Rathmann.
		40	10.0 3.22 1.25	6.12	.90	6.30 5.2 2.47	1.24 2.6 2.43		0	2.0		
	1-Heptance - benzene 50:50	20	10.0 3.22 1.25	10.9	1.1	9.67 6.3 2.55	2.75 4.35 2.62		0.06	3.3	56.2	Rathmann.
		40	12.5 10.0 3.22 1.25	9.70	1.1	9.62 9.38 6.9 3.28	1.48 2.08 3.77 2.92		.07	2.4		
	C_{14}											
$C_{14}H_6Cl_2O_2$	1,8 - Dichloroanthraquinone											
	Solvent: Benzene	23	430								39	Budó.
	2,3 - Dichloroanthraquinone.										39.1	Fischer.
	Solvent: Benzene	23	430								39 39.1	Budó. Fischer.

TABLE 5. *Dielectric dispersion parameters and numerical data for dilute nonaqueous solutions*—Continued

	Solution	t (°C)	λ (cm)	$\left(\frac{\Delta\epsilon'}{c}\right)_\infty$	$\left(\frac{\Delta\epsilon'}{c}\right)_0$	$\frac{\Delta\epsilon'}{c}$	$\frac{\Delta\epsilon''}{c}$	$\frac{\Delta \tan\delta}{c}$	α_{Cole}	λ_c(cm)	References
	C_{14}—Continued										
$C_{14}H_7ClO_2$	1-Chloroanthraquinone										
	Solvent: Benzene	23	430								49.1 Fischer.
	2-Chloroanthraquinone										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_{14}H_{13}I$	3,3′-Dimethyl-4-iodobiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
	2,2′-Dimethyl-4-iodobiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{14}H_{13}IO_2$	3,3′-Dimethoxy-4-iodobiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{14}H_{14}$	3,3′-Dimethylbiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
	2,2′-Dimethylbiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{14}H_{14}O_2$	4,4′-Dimethoxybiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
	3,3′-Dimethoxybiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{14}H_{29}Br$	Bromotetradecane										
	Solvents: Carbon tetrachloride	20	10.0 3.22 1.27	4.20	0.0	2.68(x) 1.18 0.41	1.46(x) 1.27 0.90		0.20	6.7	52 Curtis.
		40	10.0 3.22 1.27	3.76	.0	2.70 1.46 0.54	1.20 1.28 0.95		.19	4.7	
		60	10.0 3.22	3.34	.0	2.76 1.60	.98 1.18		.18	3.3	
	1-Heptane	4	10.0 5.59	3.40	.59	2.62(x) 2.52	1.00(x) 0.92				
		20	10.0 5.59 3.22 1.27	3.22	.59	2.60 2.38 1.72 1.00	.83 .89 .96 .71		.18	4.1	
		40	10.0 5.59 3.22	3.00	.59	2.55 2.28 1.82	.70 .76 .86		.18	3.1	

		60	10.0 5.59 3.22 1.27	2.79	.59	2.53 2.16 1.94 1.23	.65 .66 .76 .81		.19	2.4	
	Paraffin	4	3.22 1.27	1.60	.11	0.27(x) .22	.21(x) .12		.38	35	
		20	10.0 5.59 3.22 1.27	1.46	.11	.59 .51 .31 .21	.36 .34 .25 .16		.36	19	
		40	10.0 5.59 3.22 1.27	1.32	.11	.66 .59 .33 .20	.34 .32 .30 .21		.32	12	
		60	10.0 5.59 3.22 1.27	1.15	.11	.73 .68 .42 .20	.32 .35 .32 .24		.27	6.6	
	C_{16}										
$C_{16}H_{18}O_4$	3,5,3′,5′-Tetramethoxybiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{16}H_{18}O_2$	3,3′-Diethoxybiphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{16}H_{33}Br$	1-Bromohexadecane										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_{16}H_{33}Cl$	1-Chlorohexadecane										
	Solvent: Benzene	23	430								49.1 Fischer.
$C_{16}H_{34}O$	1-Hexadecanol										
	Solvent: Benzene	23	430								49.1 Fischer.
		24	382								36 Martin.
	C_{24}										
$C_{24}H_{38}O_4$	Dioctyl phthalate										
	Solvent: Benzene	20	(1 to 10)								52 Srivastava.
	C_{28}										
$C_{28}H_{26}$	2″,3,3′,3‴-Tetramethyl-p-quaterphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
	2,2′,2‴,3″-Tetramethyl-*p*-quaterphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.
$C_{28}H_{26}O_4$	2″,3,3′,3‴-Tetramethoxy-*p*-quaterphenyl										
	Solvent: Carbon tetrachloride	25	340								53 Hase.

Table 6. *Dielectric dispersion parameters and numerical data for dilute aqueous solutions*

Solute		t (° C)	λ (cm)	Concentration, moles per liter	ε′	ε″	$\epsilon_{\lambda=\infty}$	$\epsilon_{\lambda=0}$	α_{Cole}	λ_c (cm)	References
C_2H_7N	Ethyl amine	25	9.22 3.175 1.264	0.6	72.4 57.6 30.1	12.9 30.0 33.1	[a] 75.0	5.5	0	1.77	52 Haggis.
			3.175 1.265	1.16	55.2 27.9	30.8 31.7	[a] 72.5	5.5	0	1.84	
$C_2H_8N_2$	Ethylenediamine	25	9.22 3.175 1.264	0.525	74.3 59.7 31.3	12.0 29.2 33.0	[a] 75.5	5.5	0	1.75	
			9.22	1.05	71.0	12.5	[a] 73.0	5.5			
			9.22 3.175 1.264	1.57	68.5 51.5 24.7	13.5 30.2 29.5	[a] 71.0	5.5	0	2.06	
C_3H_8O	1-Propanol	25	9.22 3.175 1.264	0.33	72.6 61.3 31.6	12.5 29.3 33.3	[a] 75.5	5.5	0	1.69	
			9.22 3.175 1.264	.66	70.7 58.2 29.5	13.0 30.2 32.0	[a] 73.9	5.5	0	1.81	
			9.22 3.175 1.264	1.0	70.0 54.9 27.1	14.6 30.3 31.3	[a] 72.3	5.5	0	1.94	
	2-Propanol	25	9.22 1.264	0.33	74.8 31.6	11.5 33.8	[a] 75.9	5.5	0	1.63	
			9.22 1.264	.66	72.3 28.9	11.0 32.3	[a] 73.4	5.5	0	1.73	
			1.264	1.0	26.2	30.7	[a] 70.9	5.5	0	1.85	
$C_3H_6O_2$	Propionic acid	25	9.22 3.175 1.264	0.5	73.3 59.1 31.4	12.7 28.5 33.3	[a] 75.0	5.5	0	1.66	
			9.22 3.175 1.264	1.0	69.4 55.4 28.9	13.4 28.5 31.4	[a] 71.5	5.5	0	1.77	
			9.22 3.175 1.264	1.5	65.7 51.4 26.4	13.0 28.7 29.6	[a] 68.4	5.5	0	1.91	
C_3H_9N	1-Propylamine	25	1.264	0.33 .66	31.8 28.8	33.7 31.6					
$C_4H_{10}O$	2-Methyl-2-propanol	25	9.22 3.175 1.264	.33	73.7 59.9 31.6	12.9 29.6 33.3	[a] 75.9	5.5	0	1.74	
			9.22 3.175	.66	71.6 55.1	14.6 30.1	[a] 73.5	5.5	0	1.90	
			9.22 3.175	1.0	69.9 50.4	15.3 30.2	[a] 71.5	5.5	0	2.06	
$C_5H_8O_4$	Glutaric acid	25	9.22 3.175 1.264	0.33	73.6 60.6 32.5	13.1 28.4 33.1	[a] 74.9	5.5	0	1.63	
			9.22 3.175 1.264	1.0	65.6 53.5 28.6	13.1 26.2 28.8	[a] 68.0	5.5	0	1.71	
$C_5H_{10}O$	1-Pentanone	25	9.22 3.175 1.264	0.17	75.2 62.2 33.2	10.6 29.0 35.0	[a] 77.0	5.5	0	1.62	
			9.22 3.175 1.264	.33	74.6 61.1 31.6	10.8 29.3 34.1	[a] 76.5	5.5	0	1.67	
C_6H_6O	Phenol	25	9.22 3.175 1.264	.25	74.6 61.3 32.1	11.5 28.2 33.6	[a] 75.6	5.5	0	1.62	
			9.22 3.175 1.264	.5	71.3 58.4 29.1	12.1 27.9 31.2	[a] 73.0	5.5	0	1.67	
C_6H_7N	Aniline	25	9.22 3.175 1.264	.125	75.5 62.9 33.6	10.3 28.4 35.2	[a] 77.1	5.5	0	1.58	
			9.22 3.175 1.264	.25	74.1 61.9 32.5	10.4 28.3 34.2	[a] 76.0	5.5	0	1.61	

[a] Adjusted.

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THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its headquarters in Washington, D. C., and its major laboratories in Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside front cover.

WASHINGTON, D. C.

Electricity and Electronics. Resistance and Reactance. Electron Devices. Electrical Instruments. Magnetic Measurements. Dielectrics. Engineering Electronics. Electronic Instrumentation. Electrochemistry.

Optics and Metrology. Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

Heat. Temperature Physics. Thermodynamics. Cryogenic Physics. Rheology. Engine Fuels. Free Radicals Research.

Atomic and Radiation Physics. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Neutron Physics. Radiation Physics. Radioactivity. X–rays. High Energy Radiation. Nucleonic Instrumentation. Radiological Equipment.

Chemistry. Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

Mechanics. Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity, Density, and Fluid Meters. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

Building Technology. Structural Engineering. Fire Protection. Air Conditioning, Heating, and Refrigeration. Floor, Roof, and Wall Coverings. Codes and Safety Standards. Heat Transfer.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

Data Processing Systems. SEAC Engineering Group. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Application Engineering.

- Office of Basic Instrumentation
- Office of Weights and Measures

BOULDER, COLORADO

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

Radio Propagation Physics. Upper Atmosphere Research. Ionospheric Research. Regular Propagation Services. Sun-Earth Relationships. VHF Research.

Radio Propagation Engineering. Data Reduction Instrumentation. Modulation Systems. Navigation Systems. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Radio Systems Application Engineering. Radio Meteorology.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. High Frequency Impedance Standards. Electronic Calibration Center. Microwave Physics. Microwave Circuit Standards.

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