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A Bibliography of Thermophysical Properties of Methane from 0 to 300 °K

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A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES OF METHANE FROM 0 TO 300 °K

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CONTENTS

A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES OF METHANE FROM 0 TO 300°K [1]

L. A. Hall

References together with an abbreviated abstract are presented for mechanical, thermodynamic, and transport properties *) of methane from 0 to 300°K published up to December 1967. A total of 660 articles have been indexed. Each article has been reviewed and coded with regard to properties studied, type of article (i.e., experimental, theoretical, etc.), and method of presentation of data. The temperature and pressure ranges for each property under consideration are also given. An index has been prepared according to property with four sub-categories: solid, liquid, gas up to 200°K, and gas above 200°K.

*) density, P-V-T data, compressibility factor, expansivity, compressibility, equation of state, vapor pressure, melting pressure, latent heats, fixed points, specific heat, velocity of sound, Joule-Thomson coefficients, entropy, enthalpy, internal energy, fugacity, Gibbs function, Helmholtz function, thermal conductivity, viscosity, Prandtl number, self-diffusion coefficient, surface tension, dielectric constant, refractive index

Key words: methane, low temperature, thermodynamic properties, transport properties, mechanical properties, equation of state, bibliography

1. INTRODUCTION

The Compilation Unit of the Cryogenic Data Center has in its mission the critical evaluation of quantitative information from the world's literature related to the thermophysical properties of materials at cryogenic temperatures. At the outset of the study of a particular material, copies of the documents concerned with the properties are obtained and reviewed. As the task of document accumulation continues, a concerted effort is made to complete a systematic and thorough literature search on the selected topic. This bibliography on the properties of methane is the first step in the current methodical organization of the

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[1] This study was supported in part by the National Aeronautics and Space Administration, Contr. No. R-06-006-046.

literature on methane. Primarily, our search was for articles dealing with properties studied in the temperature range 0 to 300°K, however, articles containing higher temperatures were included as they came to our attention.

For methane, the collection of documents began over nine years ago in conjunction with the data compilation presented in the Compendium."[1] The initial literature search was conducted by the use of various abstracting journals, in particular Chemical Abstracts. Copies of the articles were obtained at that time and reviewed for useful data. From the time of the "Compendium's" publication to the present, the Compilation Unit of the Cryogenic Data Center has been actively acquiring all articles dealing with the thermophysical properties of methane at cryogenic temperatures. These articles were entered into our Storage and Retrieval System together with all the other cryogenically oriented documents that have come to our attention by a systematic scanning of the primary journals, and secondary publications such as Chemical Abstracts, Physics Abstracts, NASA STAR, Nuclear Science Abstracts, DDC TAB, and International Aerospace Abstracts. A computer search of the Storage and Retrieval System provided most of the references for this annotated bibliography. All pertinent documents from the references listed in this search were reviewed and coded. In addition, other articles, which were referenced in these documents, were also obtained, reviewed, and coded.

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[1] "A Compendium of the Properties of Materials at Low Temperature (Phase I), Part I. Properties of Fluids," V. J. Johnson, editor, Wright Air Development Division Tech. Rept. 60-56 (1960), 560 pp., DDC AD 249 777.

2. FORMAT FOR LISTING CITATION AND DOCUMENT CONTENTS

The citations have been arranged alphabetically by first author and numbered. Only information from the article which concerns the properties of methane was noted in this bibliography. The temperature and pressure ranges were omitted on references to state points such as triple point, normal melting and boiling points, and critical point. In many cases the pressures were not stated in the article. This is most often the case for study of properties near atmospheric pressure that are essentially temperature-dependent only.

The information given for each citation includes and is ordered as follows:

1. author(s),
2. title (original language) and translated title, if original is in a language other than English,
3. reference (If the same article is published in more than one place, each reference is cited.),
4. properties studied for methane, state of substance, temperature and pressure ranges as available,
5. designation as to primary character of article,
   a. experimental
   b. theoretical
   c. compilation [1]
   d. correlation
   e. reference book [2]
6. form in which data are reported,
   a. tabular - tables (number of values)
   b. graphical
   c. equations
   d. apparatus, if described or illustrated

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[1] In compilations, the bibliography number of the original article from which the data was obtained is listed if the source of the data is mentioned.

[2] The amount of data in reference books is not given.

3. INDEX OF PROPERTIES

The bibliography is indexed according to property with sub-indexes for the state of the substance; i.e., solid, liquid, gas up to 200°K, and gas above 200°K. The letters E, T, C, and R following each citation number refer to the type of data; i.e., E = experimental, T = theoretical, C = compilation, correlation, calculation, and R = review, discussion, reference work. A few reference books were coded by property only.

1. DENSITY, P-V-T DATA, COMPRESSIBILITY FACTOR

10 E 11 E 12 E 14 E 17 T 26 T 29 E 30 E 31 E 33 C
34 C 37 T 48 C 54 T 58 T 60 E 61 E 62 T 63 R 66 E
71 C 75 C 79 E 81 C 82 C 83 C 93 T 109 E 115 C 116 C
125 C 132 E 137 E 138 E 145 R 146 C 149 E 152 E 153 E 160 C
161 R 175 T 181 T 186 E 190 E 192 C 213 C 214 T 220 T 222 T
225 C 229 C 230 C 237 T 241 E 242 E 247 R 250 C 251 C 253 E
257 C 258 E 273 C 282 E 288 E 291 C 305 E 306 T 307 E 308 E
321 C 327 C 332 C 344 E 361 C 367 C 368 E 369 C 375 C 378 C
386 E 388 T 389 C 390 T 391 T 396 C 397 E 400 C 401 C 402 T
413 C 415 E 416 E 418 T 428 E 431 E 437 C 438 C 443 E 446 E
447 E 450 T 451 T 461 E 466 C 469 T 472 T 479 T 480 T 483 T
484 T 488 T 491 C 492 E 495 C 497 C 498 T 503 C 507 R 515 E
516 C 518 C 522 E 530 E 540 E 543 E 557 E 558 R 559 C 571 T
582 C 594 E 596 E 609 E 614 E 616 C 617 E 618 T 625 C 632 E
633 C 650 T 658 T

SOLID

14 E 63 R 109 E 116 C 213 C 241 E 242 E 273 C 282 E 386 E
515 E 543 E 557 E 558 R 596 E

LIQUID

14 E 17 T 26 T 33 C 48 C 54 T 66 E 83 C 109 E 116 C
125 C 132 E 175 T 192 C 213 C 220 T 229 C 230 C 237 T 247 R
257 C 273 C 291 C 375 C 397 E 400 C 418 T 428 E 446 E 447 E
461 E 469 T 483 T 484 T 488 T 503 C 515 E 594 E 614 E 616 C
618 T

GAS (UP TO 200 DEGREES K)

26 T 33 C 54 T 58 T 62 T 75 C 81 C 83 C 116 C 125 C
145 R 149 E 160 C 161 R 213 C 247 R 251 C 253 E 258 E 273 C
291 C 327 C 375 C 391 T 400 C 401 C 413 C 431 E 437 C 443 E
451 T 461 E 469 T 522 E 559 C 571 T 582 C 594 E 616 C 617 E
625 C 650 T

GAS (ABOVE 200 DEGREES K)

10 E 11 E 12 E 29 E 30 E 31 E 34 C 37 T 54 T 58 T
62 T 75 C 79 E 81 C 82 C 83 C 125 C 137 E 138 E 145 R
146 C 152 E 153 E 160 C 161 R 186 E 213 C 225 C 247 R 251 C
253 E 257 C 273 C 288 E 291 C 305 E 306 T 307 E 327 C 332 C
344 E 361 C 368 E 369 C 375 C 378 C 388 T 389 C 390 T 391 T
396 C 400 C 431 C 413 C 415 E 416 E 431 E 437 C 438 C 443 E
450 T 451 T 461 E 466 C 469 T 472 T 479 T 492 E 516 C 518 C
530 E 540 E 559 C 571 T 582 C 594 E 616 C 617 E 625 C 632 E
650 T 658 T

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

1. DENSITY, P-V-T DATA, COMPRESSIBILITY FACTOR (CONT.)

SATURATED LIQUID

26 T 60 E 61 E 71 C 93 T 125 C 145 R 161 R 181 T 190 E
214 T 222 T 250 C 308 E 321 C 367 C 375 C 396 C 401 C 480 T
483 T 491 C 495 C 498 T 507 R 558 R 559 C 609 E 633 C

SATURATED VAPOR

26 T 60 E 61 E 115 C 125 C 145 R 161 R 214 T 222 T 225 C
250 C 308 E 321 C 367 C 396 C 401 C 402 T 480 T 495 C 497 C
559 C 617 E 633 C

2. EQUATION OF STATE, VIRIAL COEFFICIENTS

8 T 35 T 36 T 38 T 39 T 40 T 41 E 43 T 44 T 49 T
54 T 55 C 58 T 74 T 84 T 127 T 152 E 153 E 154 T 215 T
216 T 218 T 219 T 226 T 231 T 238 R 247 R 249 T 253 E 254 E
266 T 277 E 281 T 282 E 289 T 296 C 299 T 307 E 310 T 311 T
312 T 313 T 318 T 327 C 335 T 349 E 355 T 372 T 388 T 389 C
390 T 391 T 394 T 401 C 427 T 431 E 441 T 450 T 451 T 471 T
472 T 479 T 480 T 492 E 527 T 530 E 537 T 538 T 568 T 572 T
573 T 579 T 589 T 590 E 591 E 614 E 617 E 618 T 632 E 649 T
650 T 660 C

LIQUID

39 T 43 T 54 T 231 T 247 R 249 T 277 E 394 T 480 T 589 T
614 E 618 T

GAS (UP TO 200 DEGREES K)

35 T 36 T 40 T 43 T 54 T 58 T 74 T 84 T 127 T 218 T
226 T 238 R 247 R 253 E 254 E 266 T 277 E 281 T 282 E 289 T
296 C 299 T 310 T 311 T 318 T 327 C 335 T 355 T 372 T 389 C
401 C 427 T 431 E 441 T 451 T 471 T 480 T 537 T 568 T 572 T
579 T 589 T 590 E 591 E 617 E 649 T 650 T 660 C

GAS (ABOVE 200 DEGREES K)

8 T 35 T 36 T 38 T 40 T 41 E 43 T 44 T 49 T 54 T
55 C 58 T 74 T 84 T 127 T 152 E 153 E 154 T 215 T 216 T
218 T 219 T 226 T 238 R 247 R 253 E 254 E 266 T 277 E 281 T
282 E 289 T 296 C 299 T 307 E 310 T 311 T 312 T 313 T 318 T
327 C 335 T 349 E 355 T 372 T 388 T 389 C 390 T 391 T 401 C
427 T 431 E 441 T 450 T 451 T 471 T 472 T 479 T 492 E 527 T
530 E 537 T 538 T 568 T 572 T 573 T 579 T 590 E 591 E 617 E
632 E 649 T 650 T 660 C

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

3. IDEAL GAS PROPERTY (ROTATIONAL HEAT CAPACITY)

376 T 621 C 653 R

4. EXPANSIVITY AND COMPRESSIBILITY

50 E 210 E 214 T 231 T 282 E 352 E 384 R 387 E 488 T 507 R
555 E 556 E 609 E

SOLID

50 E 210 E 387 E 555 E 556 E

LIQUID

231 T 488 T 507 R 609 E

GAS (UP TO 200 DEGREES K)

282 E

GAS (ABOVE 200 DEGREES K)

282 E 352 E 384 R

5. VAPOR PRESSURE

SOLID

21 E 22 C 186 E 233 T 236 E 252 C 261 C 263 E 271 E 273 C
285 E 292 C 342 E 364 C 397 E 433 C 445 E 490 C 503 C 558 R
570 C 593 E 653 R 659 C 660 C

LIQUID

22 C 52 T 60 E 61 E 75 C 93 T 102 E 105 E 108 E 124 C
130 E 140 E 141 E 143 E 145 R 162 C 166 T 170 E 185 E 188 T
192 C 212 T 213 C 214 T 222 T 233 T 236 E 239 E 252 C 263 E
271 E 273 C 292 C 308 E 322 E 323 C 324 C
396 C 400 C 401 C 414 T 419 R 433 C 445 E 463 T 469 T 484 T
490 C 493 C 498 T 503 C 507 R 547 C 553 T 563 E 564 E 570 C
587 R 588 C 594 E 613 E 614 E 617 E 618 T 628 E 633 C 652 E
656 C 657 C 659 C 660 C

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

6. MELTING PRESSURE

103 R 109 E 186 E 210 E 273 C 356 T 558 R 569 E

7. LATENT HEATS

SOLID PHASE TRANSITION

104 E 184 E 273 C 342 E 458 C

HEAT OF SUBLIMATION

63 R 118 E 640 C 641 C 660 C

HEAT OF FUSION

63 R 104 E 118 E 171 E 273 C 292 C 294 C 342 E 367 C 458 C
490 C 503 C 504 C 558 R

HEAT OF VAPORIZATION

33 C 93 T 95 C 119 E 145 R 170 E 185 E 192 C 239 E 273 C
277 E 278 E 292 C 294 C 308 E 367 C 396 C 401 C 456 C 469 T
490 C 495 C 503 C 504 C 523 E 542 C 558 R 592 R 623 T 624 T
633 C 655 C 660 C

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

8. FIXED POINTS (SOLID TRANSITIONS, TRIPLE POINT, NORMAL MELTING AND BOILING POINTS, CRITICAL POINT)

SOLID TRANSITIONS

28 E	50 E	103 R	106 E	107 E	117 E	151 E	187 E	228 E	242 E
286 T	342 E	529 E	554 E	555 E	556 E	580 T	642 C		

TRIPLE POINT

21 E	22 C	32 T	103 R	107 E	109 E	116 C	118 E	129 E	145 R
176 T	191 T	192 C	323 C	342 E	370 E	384 R	396 C	397 E	411 E
447 E	490 C	503 C	504 C	558 R	593 E	618 T	633 C	657 C	660 C

NORMAL MELTING POINT

62 T	213 C	262 E	342 E	367 C	370 E	396 C

NORMAL BOILING POINT

22 C	48 C	80 T	116 C	145 R	161 R	176 T	192 C	213 C	257 C
262 E	290 C	308 E	323 C	350 E	384 R	411 E	445 E	446 E	447 E
490 C	498 T	503 C	504 C	558 R	618 T	633 C	660 C		

CRITICAL POINT

22 C	26 T	47 E	48 C	61 E	62 T	85 E	86 E	87 E	88 E
93 T	145 R	157 C	160 C	161 R	166 T	176 T	180 C	192 C	213 C
230 C	234 R	238 R	257 C	290 C	291 C	308 E	323 C	326 C	355 T
365 C	367 C	372 T	384 R	396 C	400 C	429 C	438 C	445 E	447 E
467 R	479 T	483 T	484 T	490 C	494 C	495 C	496 T	498 T	503 C
522 E	540 T	558 R	560 T	589 T	617 E	618 T	633 C	643 E	651 C
657 T	660 C								

E = experimental, T = theoretical, C = compilation, correlation, calculation, and R = review, discussion, reference work.

9. SPECIFIC HEAT

25 C 28 E 36 T 72 E 76 C 78 E 92 C 104 E 106 E 107 E
114 T 117 E 118 E 130 E 145 R 147 E 148 C 156 C 157 C 158 C
159 R 160 C 164 C 168 R 170 E 171 E 172 E 173 E 174 E 178 C
184 E 192 C 203 E 211 C 213 C 223 E 239 E 240 E 247 R 260 E
262 E 270 C 273 C 277 E 278 E 280 T 287 E 291 C 292 C 293 C
294 C 300 E 328 E 351 E 361 C 362 R 367 C 369 C 373 E 375 C
387 E 391 T 393 R 405 C 407 C 417 E 452 C 468 C 486 C 487 T
489 E 490 C 493 C 503 C 504 C 505 R 507 R 513 C 535 E 539 C
544 C 548 C 549 C 550 T 558 R 575 C 576 T 595 E 597 E 599 C
600 C 601 E 607 C 609 E 614 E 618 T 627 E 631 C 633 C 640 C
641 C 643 E 648 C 650 T 653 R 654 C

SOLID

28 E 104 E 106 E 107 E 117 E 118 E 145 R 171 E 173 E 174 E
184 E 213 C 273 C 292 C 294 C 387 E 493 C 558 R 595 E 597 E
640 C 641 C 653 R

LIQUID

104 E 107 E 118 E 130 E 171 E 192 C 247 R 273 C 277 E 278 E
291 C 292 C 294 C 375 C 507 R 607 C 609 E 614 E 618 T 654 C

GAS (UP TO 200 DEGREES K)

36 T 114 T 145 R 148 C 157 C 158 C 159 R 160 C 170 E 192 C
203 E 211 C 213 C 240 E 247 R 273 C 277 E 278 E 291 C 292 C
294 C 300 E 375 C 391 T 417 E 493 C 513 C 539 C 550 T 599 C
600 C 648 C 650 T

GAS (ABOVE 200 DEGREES K)

36 T 72 E 76 C 78 E 114 T 145 R 147 E 148 C 156 C 157 C
158 C 159 R 160 C 164 C 168 R 170 E 172 E 178 C 192 C 203 E
211 C 213 C 223 E 240 E 247 R 260 E 262 E 270 C 273 C 277 E
278 E 280 T 287 E 291 C 293 C 294 C 300 E 328 E 351 E 361 C
367 C 369 C 373 E 391 T 393 R 417 E 452 C 468 C 489 E 493 C
513 C 535 E 539 C 544 C 550 T 576 T 599 C 601 E 627 E 631 C
648 C 650 T

SATURATED LIQUID

145 R 159 R 213 C 239 E 273 C 486 C 493 C 507 R 607 C 609 E
633 C 643 E

SATURATED VAPOR

633 C

IDEAL GAS

25 C 92 C 145 R 160 C 164 C 362 R 405 C 407 C 487 T 490 C
503 C 504 C 505 R 548 C 549 C 575 C

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R = review, discussion, reference work.

10. VELOCITY OF SOUND

1 E 50 E 147 E 224 T 345 E 346 E 347 C 348 E 349 E 378 C
440 T 473 E 507 R 539 C 545 R 559 C 586 E 609 E 611 E 612 E
614 E 615 E 619 E 650 T

SOLID

50 E 586 E

LIQUID

224 T 440 T 507 R 559 C 609 E 611 E 612 E 614 E 615 E 619 E

GAS (UP TO 200 DEGREES K)

473 E 539 C 559 C 650 T

GAS (ABOVE 200 DEGREES K)

1 E 147 E 345 E 346 E 347 C 348 E 349 E 378 C 473 E 539 C
545 R 559 C 650 T

11. JOULE-THOMSON, INVERSION CURVE

5 E 23 C 77 C 78 E 145 R 154 T 156 C 182 C 195 C 217 C
218 T 281 T 329 T 330 T 331 T 372 T 427 T 462 C 605 C 614 C
630 R

12. ENTROPY, ENTHALPY, INTERNAL ENERGY, FUGACITY, GIBBS FUNCTION, HELMHOLTZ FUNCTION

5 E 33 C 36 T 43 T 45 T 46 C 58 T 59 C 62 T 82 C
83 C 92 C 99 C 103 R 112 C 115 C 116 C 118 E 131 C 137 E
145 R 156 C 157 C 158 C 160 C 161 R 169 R 170 E 176 T 204 C
209 T 214 T 239 E 247 R 251 C 273 C 277 E 280 T 290 C 291 C
293 C 294 C 321 C 339 C 361 C 362 R 374 C 375 C 377 C 383 C
391 T 396 C 401 C 405 C 407 C 416 E 439 C 449 T 454 C 464 R
468 C 476 T 483 T 484 T 487 T 488 T 490 C 503 C 504 C 516 C
518 C 519 C 520 E 531 C 567 C 584 C 614 E 620 C 627 E 631 E
633 C 643 E 648 C 650 T 660 C

SOLID

116 C 118 E 169 R 176 T 214 T

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

12. ENTROPY, ENTHALPY, ETC. (CONT.)

LIQUID

33 C 43 T 45 T 59 C 83 C 116 C 131 C 145 R 158 C 161 R
176 T 214 T 239 E 247 R 273 C 277 E 290 C 291 C 321 C 374 C
375 C 396 C 401 C 449 T 464 R 483 T 484 T 488 T 531 C 614 E
633 C 643 E

GAS (UP TO 200 DEGREES K)

33 C 36 T 43 T 45 T 46 C 58 T 59 C 62 T 83 C 103 R
112 C 115 C 116 C 118 E 145 R 157 C 158 C 160 C 161 R 170 E
239 E 247 R 251 C 273 C 277 E 290 C 291 C 321 C 375 C 391 T
396 C 401 C 449 T 454 C 464 R 476 T 520 E 531 C 633 C 643 E
648 C 650 T

GAS (ABOVE 200 DEGREES K)

5 E 36 T 43 T 45 T 46 C 58 T 59 C 62 T 82 C 83 C
99 C 103 R 112 C 137 E 145 R 156 C 157 C 158 C 160 C 161 R
170 E 204 C 209 T 247 R 251 C 277 E 280 T 290 C 291 C 293 C
294 C 321 C 339 C 361 C 362 R 375 C 377 C 383 C 391 T 396 C
401 C 416 E 439 C 454 C 464 R 468 C 476 T 516 C 518 C 519 C
520 E 531 C 567 C 584 C 620 C 627 E 631 C 648 C 650 T

IDEAL GAS

59 C 92 C 145 R 239 E 405 C 407 C 487 T 490 C 503 C 504 C
505 R 660 C

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

13. THERMAL CONDUCTIVITY

19 T 20 T 24 E 53 T 54 T 68 E 72 E 73 T 84 T 90 E
96 C 97 E 98 E 101 T 110 T 112 C 114 T 123 C 133 E 135 C
167 E 168 R 183 E 193 C 194 C 196 C 197 C 199 E 202 E 208 E
211 C 213 C 232 R 244 T 247 R 255 T 256 T 264 E 272 C 273 C
275 E 283 E 295 T 300 E 301 E 302 E 303 E 304 R 309 C 351 E
357 R 358 E 359 E 360 E 366 T 369 C 381 C 385 E 395 T 399 C
409 E 422 E 423 C 424 C 425 E 436 C 448 T 455 C 493 C 525 T
528 E 533 E 535 E 536 E 546 E 558 R 561 C 565 T 566 E 575 C
585 C 604 E 606 E 622 E 629 E 634 R 637 E 638 E 646 E 647 E

SOLID

202 E 273 C 558 R

LIQUID

68 E 101 T 193 C 247 R 255 T 256 T 264 E 273 C 295 T 304 R
366 T 409 E 561 C 585 C 606 E 634 R

GAS (UP TO 200 DEGREES K)

19 T 20 T 53 T 54 T 73 T 84 T 96 C 110 T 112 C 114 T
133 E 135 C 167 E 196 C 197 C 211 C 213 C 232 R 244 T 247 R
273 C 275 E 300 E 303 E 304 R 357 R 399 C 423 C 424 C 436 C
455 C 493 C 561 C 565 T 575 C 585 C 622 E 638 E

GAS (ABOVE 200 DEGREES K)

19 T 20 T 24 E 53 T 54 T 72 E 73 T 84 T 90 E 96 C
97 E 98 E 112 C 114 T 123 C 133 E 135 C 167 E 168 R 183 E
193 C 194 C 196 C 197 C 199 E 208 E 211 C 213 C 232 R 244 T
247 R 272 C 273 C 275 E 283 E 300 E 301 E 302 E 303 E 304 R
309 C 351 E 357 R 358 E 359 E 360 E 369 C 381 C 385 E 395 T
399 C 422 E 423 C 424 C 425 E 436 C 448 T 455 C 493 C 525 T
528 E 533 E 535 E 536 E 546 E 561 C 565 T 566 E 575 C 585 C
604 E 629 E 637 E 646 E 647 E

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

14. VISCOSITY

3 E	4 C	7 C	17 T	27 E	29 E	30 E	51 E	54 T	57 T
66 E	67 E	69 T	70 C	72 E	84 T	89 E	91 E	101 T	111 T
112 C	113 T	114 T	120 C	121 C	122 E	126 C	134 T	136 E	155 C
163 T	165 R	168 R	175 T	177 T	179 C	192 C	194 C	200 E	201 E
205 E	206 E	207 C	211 C	213 C	232 R	244 T	245 T	246 T	247 R
249 T	258 E	259 E	265 E	267 E	268 C	273 C	276 E	279 C	284 C
295 T	297 E	298 T	300 E	335 T	340 E	341 T	343 E	351 E	353 C
354 T	363 T	365 C	369 C	380 E	382 C	395 T	404 E	406 T	408 T
429 C	436 C	442 T	448 T	453 C	454 C	457 E	459 C	460 E	478 E
482 T	493 C	502 E	503 C	504 C	508 T	509 E	510 C	511 E	512 E
517 E	526 T	532 E	534 R	535 E	552 T	562 T	574 T	575 C	577 E
578 E	581 C	585 C	602 E	603 E	610 E	626 E	634 R	639 C	650 T

LIQUID

4 C	17 T	54 T	57 T	66 E	67 E	101 T	134 T	175 T	177 T
192 C	200 E	201 E	247 R	249 T	258 E	259 E	273 C	279 C	295 T
363 T	408 T	457 E	459 C	460 E	503 C	504 C	509 E	510 C	511 E
512 E	577 E	578 E	634 R						

GAS (UP TO 200 DEGREES K)

54 T	69 T	84 T	111 T	112 C	113 T	114 T	120 C	121 C	136 E
155 C	163 T	165 R	192 C	211 C	213 C	244 T	245 T	246 T	247 R
258 E	259 E	273 C	276 E	279 C	284 C	298 T	300 E	335 T	340 E
341 T	365 C	429 C	436 C	442 T	453 C	454 C	459 C	460 E	493 C
508 T	526 T	552 T	562 T	574 T	575 C	585 C	610 E	626 E	639 C
650 T									

GAS (ABOVE 200 DEGREES K)

3 E	7 C	27 E	29 E	30 E	51 E	54 T	69 T	70 C	72 E
84 T	89 E	91 E	111 T	112 C	113 T	114 T	120 C	121 C	122 E
126 C	136 E	155 C	163 T	165 R	168 R	179 C	192 C	194 C	205 E
206 E	207 C	211 C	213 C	232 R	244 T	245 T	246 T	247 R	258 E
259 E	265 E	267 E	268 C	273 C	276 E	279 C	297 E	298 T	300 E
335 T	341 T	343 E	351 E	353 C	354 T	365 C	369 C	380 E	382 C
395 T	404 E	406 T	429 C	436 C	442 T	448 T	453 C	454 C	459 C
460 E	478 E	493 C	502 E	508 T	517 E	526 T	532 E	534 R	535 E
552 T	562 T	574 T	575 C	581 C	585 C	602 E	603 E	610 E	626 E
639 C	650 T								

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

15. PRANDTL NUMBER

112 C 114 T 211 C 243 C 300 E

16. SELF-DIFFUSION COEFFICIENTS

9 C 18 C 136 E 198 E 244 T 247 R 395 T 398 T 430 E 435 E
442 T 514 E 526 T 598 E 634 R 644 E 645 E

17. SURFACE TENSION

56 E 94 T 176 T 177 T 189 E 192 C 214 T 221 C 227 T 247 R
273 C 371 T 403 T 481 T 495 C 503 C 551 E 583 C

18. DIELECTRIC CONSTANT, CLAUSIUS-MOSSOTTI FUNCTION

13 E 14 E 42 R 64 E 65 E 213 C 273 C 274 E 306 T 319 E
320 E 392 C 410 E 420 C 470 E 474 E 493 C 499 E 521 E 608 E
636 E

SOLID

13 E

LIQUID

13 E 14 E 213 C 273 C 392 C 410 E 493 C

GAS (UP TO 200 DEGREES K)

42 R 499 E

GAS (ABOVE 200 DEGREES K)

42 R 64 E 65 E 213 C 274 E 319 E 320 E 420 C 470 E 474 E
521 E 608 E 636 E

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

19. REFRACTIVE INDEX

2 E 235 T 319 E 325 E 501 E 635 E

LIQUID

2 E 235 T 325 E

GAS (UP TO 200 DEGREES K)

325 E

GAS (ABOVE 200 DEGREES K)

319 E 325 E 501 E 635 E

20. LATTICE CHARACTERISTICS (CRYSTAL STRUCTURE, LIQUID STRUCTURE, DEBYE TEMPERATURE)

15 E 16 E 128 E 150 E 191 T 249 T 269 T 282 E 314 C 315 T
316 T 317 T 411 E 412 E 426 E 432 C 434 T 465 E 483 T 484 T
506 T 524 E 529 E 642 C

21. CORRESPONDING STATES

58 T 62 T 80 T 101 T 110 T 111 T 112 C 113 T 114 T 126 C
139 T 182 C 214 T 216 T 233 T 237 T 247 R 250 C 295 T 365 C
372 T 375 C 438 C 455 C 469 T 475 T 476 T 495 C 496 T 497 C
498 T 508 T 571 T 639 C

SOLID

233 T

LIQUID

80 T 101 T 214 T 233 T 237 T 247 R 250 C 295 T 469 T 475 T
496 T 498 T

GAS (UP TO 200 DEGREES K)

58 T 62 T 80 T 110 T 113 T 139 T 182 C 214 T 247 R 250 C
365 C 372 T 469 T 475 T 497 C 571 T 639 C

GAS (ABOVE 200 DEGREES K)

58 T 62 T 80 T 113 T 139 T 247 R 365 C 372 T 438 C 469 T
475 T 571 T 639 C

E = experimental, T = theoretical, C = compilation, correlation, calculation, and
R = review, discussion, reference work.

22. INTERMOLECULAR POTENTIAL

6 T 57 T 84 T 100 T 136 E 152 E 154 T 180 C 191 T 227 T
247 R 248 T 249 T 313 T 314 C 315 T 316 T 317 T 318 T 333 T
334 T 335 T 336 T 337 T 338 T 341 T 355 T 379 T 395 T 406 T
421 T 430 E 442 T 448 T 471 T 485 T 527 T 530 E 538 T 540 T
560 T 568 T 579 T 639 C 649 T

LIQUID

191 T 227 T 247 R

GAS (UP TO 200 DEGREES K)

57 T 84 T 100 T 136 E 247 R 248 T 318 T 333 T 334 T 335 T
336 T 337 T 338 T 341 T 355 T 421 T 471 T 568 T 579 T 639 C
649 T

GAS (ABOVE 200 DEGREES K)

6 T 57 T 84 T 100 T 136 E 152 E 154 T 247 R 248 T 318 T
333 T 334 T 335 T 336 T 337 T 338 T 341 T 355 T 379 T 395 T
406 T 421 T 430 E 471 T 527 T 530 E 538 T 568 T 579 T 639 C
649 T

23. DOCUMENTS NOT APPEARING IN THE PROPERTIES INDEX

142 E (INFRARED SPECTRA)
144 E (RAMAN SPECTRUM)
444 R (LIQUEFACTION OF GASES)
477 E (RAMAN SPECTRUM)
500 E (INFRARED SPECTRA)

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DISCUSSION - EQUATIONS, GRAPHS, TABLE (2 VALUES)

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COMPILATION - GRAPH

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MOLAR VOLUME, DENSITY, SPECIFIC HEAT (CONSTANT PRESSURE), ENTHALPY, ENTROPY, INTERNAL ENERGY, GIBBS FREE ENERGY, HELMHOLTZ FREE ENERGY (GAS) (203 TO 473 DEGREES K AND 10 TO 100 ATM), SPECIFIC HEAT (CONSTANT VOLUME) (248 TO 473 DEGREES K AND 10 TO 100 ATM)
CALCULATED - TABLE (1600 VALUES), GRAPH, EQUATIONS

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REFERENCE BOOK - TABLE (5 VALUES), GRAPH, EQUATION

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I. THE N-ALKANES.
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VISCOSITY (LIQUID)
THEORETICAL - EQUATIONS, TABLE OF COEFFICIENTS

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CORRELATION - EQUATIONS, NOMOGRAPH

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THEORETICAL - EQUATIONS, TABLE (5 VALUES)

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EXPERIMENTAL - TABLE (5 VALUES)

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DENSITY, VISCOSITY, THERMAL CONDUCTIVITY, SPECIFIC HEAT (P=CONSTANT, V=CONSTANT) (GAS) (273 TO 773 DEGREES K)
CALCULATION - TABLE (42 VALUES)

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NORMAL BOILING POINT, TRIPLE POINT TEMPERATURE
EXPERIMENTAL - TABLE (2 VALUES)

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THEORETICAL - TABLE (3 VALUES), EQUATIONS

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EXPERIMENTAL - TABLE (10 VALUES), EQUATION

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CORRELATION - GRAPH

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CALCULATED - EQUATIONS, TABLES (10,000 VALUES)

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IDEAL GAS PROPERTY (ROTATIONAL HEAT CAPACITIES)
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THEORETICAL - TABLE (12 VALUES), GRAPHS

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CALCULATED - ONE VALUE

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CALCULATED - TABLES (500 VALUES)

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UNLIKE-MOLECULE INTERACTIONS FROM SECOND VIRIAL COEFFICIENTS.
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THEORETICAL - TABLE (16 VALUES)

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EXPERIMENTAL - ONE TABULAR VALUE
(CORRELATION BETWEEN VISCOSITY, THERMAL CONDUCTIVITY, AND SPECIFIC HEAT (V=CONSTANT))

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COMPILATION - TABLE (10 VALUES)
DATA FROM REFERENCE 123

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COMPILATION - TABLE (46 VALUES)

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REVIEW - 7 TABULAR VALUES

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THEORETICAL - EQUATION, TABLE (6 VALUES)

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ENTHALPY, ENTROPY, EQUATION OF STATE (GAS)
CALCULATION - TABLE (12 VALUES), EQUATIONS

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(273 TO 550 DEGREES K), COMPRESSIBILITY FACTOR, ENTHALPY,
ENTROPY, SPECIFIC HEAT (V=CONSTANT) (GAS)
THEORETICAL - GRAPH, EQUATIONS

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COMPILATION - TABLE (1 VALUE)
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THEORETICAL - EQUATION

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THEORETICAL - TABLE OF PARAMETERS, GRAPHS

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COMPILATION - TABLES (540 VALUES), DATA FROM REFERENCE 401

397 MATHOT,V. STAVELEY,L.A.K. YOUNG,J.A. PARSONAGE,N.G.
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EXPERIMENTAL - TABLE (2 VALUES), GRAPH, APPARATUS

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CALCULATED - TABLE (5 VALUES), EQUATIONS

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CALCULATED - EQUATIONS, TABLE (5000 VALUES), GRAPH

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EXPERIMENTAL - TABLES (20 VALUES), APPARATUS

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CORRELATION - GRAPH

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EXPERIMENTAL - TABLE (400 VALUES), EQUATIONS

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THEORETICAL - EQUATIONS, TABLE (1 VALUE)

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COMPILATION - EQUATIONS, TABLE (6 VALUES)
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CORRELATION - EQUATIONS, GRAPHS

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CORRELATION - GRAPH, EQUATION

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COMPILATION - TABLES (175 VALUES), GRAPHS,
DATA FROM REFERENCES 122, 265, 273, 275, 276, 300, 351, 643

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EXPANSION (P = CONSTANT), THERMAL PRESSURE (V = CONSTANT),
SPECIFIC HEAT (P = CONSTANT, V = CONSTANT) (90 TO 130
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