



Springer 词典精选原版系列

SPRINGER  
REFERENCE

# 聚合物百科词典

VOLUME 5

附录

Jan W. Gooch

## Encyclopedic Dictionary of Polymers

*2nd Edition*



哈尔滨工业大学出版社  
HARBIN INSTITUTE OF TECHNOLOGY PRESS

 Springer 词典精选原版系列

# 聚合物百科词典

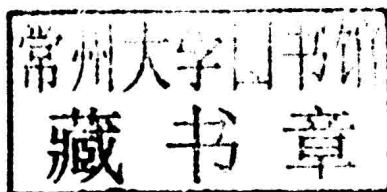
Jan W. Gooch

## Encyclopedic Dictionary of Polymers

*2nd Edition*

**VOLUME 5**

(附录)



# 黑版贸审字08-2014-010号

Reprint from English language edition:

*Encyclopedic Dictionary of Polymers*

by Jan W. Gooch

Copyright © 2011 Springer New York

Springer New York is a part of Springer Science+Business Media

All Rights Reserved

This reprint has been authorized by Springer Science & Business Media for distribution in China Mainland only and not for export therefrom.

## 图书在版编目 (CIP) 数据

聚合物百科词典. 5, 附录: 英文/ (美) 古驰 (Gooch, J. W.) 主编. — 哈尔滨: 哈尔滨工业大学出版社, 2014.3

(Springer词典精选原版系列)

ISBN 978-7-5603-4446-1

I. ①聚… II. ①古… III. ①聚合物-词典-英文 IV. ①O63-61

中国版本图书馆CIP数据核字 (2013) 第292194号



责任编辑 许雅莹 张秀华 杨 桦

出版发行 哈尔滨工业大学出版社

社 址 哈尔滨市南岗区复华四道街10号 邮编 150006

传 真 0451-86414749

网 址 <http://hitpress.hit.edu.cn>

印 刷 哈尔滨市石桥印务有限公司

开 本 787mm × 1092mm 1/16 印张 13.75

版 次 2014年3月第1版 2014年3月第1次印刷

书 号 ISBN 978-7-5603-4446-1

定 价 108.00元

---

(如因印刷质量问题影响阅读, 我社负责调换)



## 原版影印说明

1. 《聚合物百科词典》(5册)是 Springer Reference *Encyclopedic Dictionary of Polymers* (2nd Edition) 的影印版。为方便使用,由原版2卷改为5册:

第1册收录 A-C 开头的词组;

第2册收录 D-I 开头的词组;

第3册收录 J-Q 开头的词组;

第4册收录 R-Z 开头的词组;

第5册为原书的附录部分及参考文献。

2. 缩写及符号、数学符号、字母对照表、元素符号等查阅说明各册均完整给出。

由 Jan W. Gooch 主编的《聚合物百科词典》是关于高分子科学与工程领域的参考书,2007年出版第一版,2011年再版。本书收录了7500多个高分子材料方面的术语,涉及高分子材料的各个方面,如粘合剂、涂料、油墨、弹性体、塑料、纤维等,还包括生物化学和微生物学方面的术语,以及与新材料、新工艺相关的术语;并且不仅包括其物理、电子和磁学性能方面的术语,还增加了数据处理的统计和数值分析以及实验设计方面的术语。每个词条方便查找,并给出了简洁的定义,以及相互参照的相关术语。为了说明得更清晰,全书给出1160个图、73个表。有的词条还给出方程式、化学结构等。

材料科学与工程图书工作室

联系电话 0451-86412421

0451-86414559

邮 箱 yh\_bj@aliyun.com

xuyaying81823@gmail.com

zhxh6414559@aliyun.com

# Acknowledgements

The editor wishes to express his gratitude to all individuals who made available their time and resources for the preparation of this book: James W. Larsen (Georgia Institute of Technology), for his innovations, scientific knowledge and computer programming expertise that were invaluable for the preparation of the Interactive Polymer Technology Programs that accompany this book; Judith Wiesman (graphics artist), for the many graphical presentations that assist the reader for interpreting the many complex entries in this publication; Kenneth Howell (Springer, New York), for his continued support for polymer science and engineering publications; and Daniel Quinones and Lydia Mueller (Springer, Heidelberg) for supporting the printed book and making available the electronic version and accompanying electronic interactive programs that are important to the scientific and engineering readers.

# Preface

The second edition of *Encyclopedic Dictionary of Polymers* provides 40% more entries and information for the reader. A *Polymers Properties* section has been added to provide quick reference for thermal properties, crystallinity, density, solubility parameters, infrared and nuclear magnetic spectra. Interactive Polymer Technology is available in the electronic version, and provides templates for the user to insert values and instantly calculate unknowns for equations and hundreds of other polymer science and engineering relationships. The editor offers scientists, engineers, academia and others interested in adhesives, coatings, elastomers, inks, plastics and textiles a valuable communication tool within this book. In addition, the more recent innovations and biocompatible polymers and adhesives products have necessitated inclusion into any lexicon that addresses polymeric materials. Communication among scientific and engineering personnel has always been of critical importance, and as in any technical field, the terms and descriptions of materials and processes lag the availability of a manual or handbook that would benefit individuals working and studying in scientific and engineering disciplines. There is often a challenge when conveying an idea from one individual to another due to its complexity, and sometimes even the pronunciation of a word is different not only in different countries, but in industries. Colloquialisms and trivial terms that find their way into technical language for materials and products tend to create a communications fog, thus unacceptable in today's global markets and technical communities.

The editor wishes to make a distinction between this book and traditional dictionaries, which provide a word and definition. The present book provides for each term a complete expression, chemical structures and mathematic expression where applicable, phonetic pronunciation, etymology, translations into German, French and Spanish, and related figures if appropriate. This is a complete book of terminology never before attempted or published.

The information for each chemical entry is given as it is relevant to polymeric materials. Individual chemical species (e.g., ethanol) were taken from the *CRC Handbook of Chemistry and Physics*, 2004 Version, the Merck Index and other reference materials. The reader may refer to these references for additional physical properties and written chemical formulae. Extensive use was made of ChemDraw<sup>®</sup>, CambridgeSoft Corporation, for naming and drawing chemical structures (conversion of structure to name and vice versa) which are included with each chemical entry where possible. Special attention was given to the IUPAC name that is often given with the common name for the convenience of the reader.

The editor assembled notes over a combined career in the chemical industries and academic institutions regarding technical communication among numerous colleagues and helpful acquaintances concerning expressions and associated anomalies. Presently, multiple methods of nomenclature are employed to describe identical chemical compounds by common and IUPAC names (eg. acetone and 2-propanone) because the old systems (19<sup>th</sup> century European and trivial) methods of nomenclature exists with the modern International Union of Pure and Applied Chemistry, and the conflicts between them are not likely to relent in the near future including the weights and measures systems because some nations are reluctant to convert from English to metric and, and more recently, the International Systems of Units (SI). Conversion tables for converting other systems to the SI units are included in this book for this purpose. In addition, there are always the differences in verbal pronunciation, but the reasons not acceptable to prevent cogent communication between people sharing common interests.

In consideration of the many challenges confronting the reader who must economize time investment, the structure of this book is optimized with regard the convenience of the reader as follows:

- Comprehensive table of contents
- Abbreviations and symbols
- Mathematics signs
- English, Greek, Latin and Russian alphabets
- Pronunciation/phonetic symbols
- Main body of terms with entry term in English, French German and Italian
- Conversion factors

- Microbiology nomenclature and terminology
- References

The editor acknowledges the utilization of many international sources of information including journals, books, dictionaries, communications, and conversations with people experienced in materials, polymer science and engineering. A comprehensive reference section contains all of the sources of information used in this publication. Pronunciation, etymological, cross-reference and related information is presented in the style of the 11<sup>th</sup> Edition of the Meriam-Webster Dictionary, where known, for each term. The spelling for each term is presented in German, French, and Spanish where translation is possible. Each term in this book includes the following useful information:

- Spelling (in **bold face**) of each term and alternative spellings where more than one derivation is commonly used
- Phonetic spelling \- \ using internationally published phonetic symbols, and this is the first book that includes phonetic pronunciation information missing in technical dictionaries that allows the reader to pronounce the term
- Parts of speech in English following each phonetic spelling, eg. *n.*, *adj.*
- Cross-references in CAPITALS letters
- Also called *example* in italics
- Etymological information [-] for old and new terms that provides the reader the national origins of terms including root words, prefixes and suffixes; historical information is critical to the appreciation of a term and its true meaning
- French, German, Italian and Spanish spellings of the term { - }
- A comprehensive explanation of the term
- Mathematical expressions where applicable
- Figures and tables where applicable
- A comprehensive reference section is included for further research

References are included for individual entries where a publication(s) is directly attributable to a definition or description. Not all of the references listed in the Reference section are directly attributable to entries, but they were reviewed for information and listed for the reader's information. Published dictionaries and glossaries of materials were very helpful for collecting information in the many diverse and smaller technologies of the huge field of polymers. The editor is grateful that so much work has been done by other people interested in polymers.

The editor has attempted to utilize all relevant methods to convey the meaning of terms to the reader, because a term often requires more information than a standard entry in a textbook dictionary, so this book is dedicated to a complete expression. Terminology and correct pronunciation of technical terms is continuously evolving in scientific and industrial fields and too often undocumented or published, and therefore, not shared with others sometimes leading to misunderstandings. Engineering and scientific terms describe a material, procedure, test, theory or process, and communication between technical people must involve similar jargon or much will be lost in the translation as often has been the editor's experience. The editor has made an attempt to provide the reader who has an interest in the industries that have evolved from adhesives, coatings, inks, elastomers, plastics and textiles with the proper terminology to communicate with other parties whether or not directly involved in the industries. This publication is a single volume in the form of a desk-handbook that is hoped will be an invaluable tool for communicating in the spoken and written media.

Physics, electronic and magnetic terms because they are related to materials and processes (e.g., *ampere*).

Biomolecular materials and processes have in the recent decade overlapped with polymer science and engineering. Advancements in polymeric materials research for biomolecular and medical applications are rapidly becoming commercialized, examples include biocompatible adhesives for sutureless tissue bonding, liquid dressings for wounds and many other materials used for *in vitro* and *in vivo* medical applications. To keep pace with these advancements, the editor has included useful terms in the main body that are commonly used in the material sciences for these new industries.

A microbiology section has been included to assist the reader in becoming familiar with the proper nomenclature of bacteria, fungi, mildew, and yeasts – organisms that affect materials and processes because they are ubiquitous in our environment. Corrosion of materials by microorganisms is commonplace, and identification of a specific organism is critical to prevent its occurrence. Engineers and materials scientists will appreciate the extensive sections on different types of microorganisms together with a section dedicated to microbiology terminology that is useful for communicating in the jargon of biologists instead of referring to all organisms as “bugs.”



New materials and processes, and therefore new terms, are constantly evolving with research, development and global commercialization. The editor will periodically update this publication for the convenience of the reader.

Statistics, numerical analysis other data processing and experimental design terms are addressed as individual terms and as a separate section in the appendix, but only as probability and statistics relate to polymer technology and not the broad field of this mathematical science. The interactive equations are listed in the Statistics section of the Interactive Polymer Technology program.

## Interactive Polymer Technology Programs

---

Along with this book we are happy to provide a collection of unique and useful tools and interactive programs along with this Springer Reference. You will find short descriptions of the different functions below. Please download the software at the following website: <http://extras.springer.com/2011/978-1-4419-6247-8>

Please note that the file is more than 200 MB. Download the ZIP file and unzip it. It is strongly recommended to read the **ReadMe.txt** before installing. The software is started by opening the file InPolyTech.pdf and following the instructions. Detailed instructions can be found under 'Help Instructions'.

The software consists of 15 programs and tools that are briefly described in the appendix.

# Abbreviations and Symbols

| Abbreviations   | Symbols   |
|---|---|
| $A_n$   | absorption (formerly extinction) ( $= \log t_i^{-1}$ )  |
| $A$   | Area  |
| $A$   | surface   |
| $A$   | Helmholtz energy ( $A = U - TS$ )   |
| $A$   | preexponential constant [in $k = A \exp(-E^\ddagger/RT)$ ]  |
| $A_2$   | second virial coefficient   |
| $a$   | exponent in the property/molecular weight relationship ( $E^\ddagger = KM^a$ ); always with an index, e.g., $a_{ij}$ , $a_s$ , etc. |
| $a$   | linear absorption coefficient, $a = I^{-1}$   |
| absolute  | abs   |
| acre  | spell out   |
| acre-foot   | acre-ft   |
| air horsepower  | air hp  |
| alternating-current (as adjective)                      | a-c   |
| $A^m$   | molar Helmholtz energy  |
| American Society for Testing and Materials              | ASTM  |
| amount of a substance (mole)                            | n   |
| ampere  | A or amp  |
| ampere-hour   | amp-hr  |
| amplitude, an elliptic function                         | am.   |
| angle   | $\beta$   |
| angle, especially angle of rotation in optical activity | $\alpha$  |
| Angstrom unit   | $\text{\AA}$  |
| antilogarithm   | antilog   |
| $a_0$   | constant in the Moffit-Yang equation  |
| Area  | $A$   |
| Atactic   | at  |
| atomic weight   | at. wt  |
| Association   | Assn.   |
| atmosphere  | atm   |

| Abbreviations                             | Symbols  |
|---|--|
| average                                   | avg  |
| Avogadro number                           | $N_L$  |
| avoirdupois                               | avdp   |
| azimuth                                   | az or $\alpha$   |
| barometer                                 | bar.   |
| barrel                                    | bbl  |
| Baumé                                     | Bé   |
| $b_0$                                     | constant in the Mofit-Yang equation  |
| board fee (feet board measure)            | fbm  |
| boiler pressure                           | spell out  |
| boiling point                             | bp   |
| Boltzmann constant                        | k  |
| brake horsepower                          | bhp  |
| brake horsepower-hour                     | bhp-hr   |
| Brinell hardness number                   | Bhn  |
| British Standards Institute               | BSI  |
| British thermal unit <sup>1</sup>         | Btu or B   |
| bushel                                    | bu   |
| $C$                                       | heat capacity  |
| $c$                                       | specific heat capacity (formerly; specific heat); $c_p$ = specific isobaric heat capacity, $c_v$ = specific isochore heat capacity   |
| $c$                                       | "weight" concentration (= weight of solute divided by volume of solvent); IUPAC suggests the symbol $\rho$ for this quantity, which could lead to confusion with the same IUPAC symbol for density |
| $c$                                       | speed of light in a vacuum   |
| $c$                                       | speed of sound   |
| calorie                                   | cal  |
| candle                                    | c  |
| candle-hour                               | c-hr   |
| candlepower                               | cp   |
| ceiling temperature of polymerization, °C | $T_c$  |

| Abbreviations                                     | Symbols  |
|---|--|
| cent  | c or ¢   |
| center to center                                  | c to c   |
| centigram   | cg   |
| centiliter  | cl   |
| centimeter or centimeter                          | cm   |
| centimeter-gram-second (system)                   | cgs  |
| centipoise  | cP   |
| centistokes                                       | cSt  |
| characteristic temperature                        | $\Theta$   |
| chemical  | chem.  |
| chemical potential                                | $\mu$  |
| chemical shift                                    | $\delta$   |
| chemically pure                                   | cp   |
| circa, about, approximate                         | ca.  |
| circular  | cir  |
| circular mils                                     | cir mils   |
| cis-tactic  | ct   |
| $C^m$   | molar heat capacity                                |
| coefficient                                       | coef   |
| cologarithm                                       | colog  |
| compare   | cf.  |
| concentrate                                       | conc   |
| conductivity                                      | cond, $\lambda$                                    |
| constant  | const  |
| continental housepower                            | cont hp  |
| cord  | cd   |
| cosecant  | csc  |
| cosine  | cos  |
| cosine of the amplitude, an elliptic function     | cn   |
| cost, insurance, and freight                      | cif  |
| cotangent   | cot  |
| coulomb   | spell out  |
| counter electromotive force                       | cemf   |
| $C_{tr}$  | transfer constant ( $C_{tr} = k_{tr}/k_p$ )        |
| cubic   | cu   |
| cubic centimeter (liquid, meaning milliliter. ml) | cu, cm, $\text{cm}^3$                              |
| cubic centimeter                                  | $\text{cm}^3$ cubic expansion coefficient $\alpha$ |
| cubic foot  | cu ft  |
| cubic feet per minute                             | cfm  |
| cubic feet per second                             | cfs  |

| Abbreviations                               | Symbols   |
|---|---|
| cubic inch                                  | cu in.  |
| cubic meter                                 | cu m or $\text{m}^3$  |
| cubic micron                                | cu $\mu$ or cu $\mu\text{m}$ or $\mu^3$   |
| cubic millimeter                            | cu mm or $\text{mm}^3$  |
| cubic yard                                  | cu yd   |
| current density                             | spell out   |
| cycles per second                           | spell out or c  |
| cylinder                                    | cyl   |
| D   | diffusion coefficient   |
| $D_{\text{rot}}$                            | rotational diffusion coefficient  |
| day   | spell out   |
| decibel                                     | db  |
| decigram                                    | d.g.  |
| decomposition, $^{\circ}\text{C}$           | $T_{dc}$  |
| degree                                      | deg or $^{\circ}$   |
| degree Celsius                              | $^{\circ}\text{C}$  |
| degree centigrade                           | C   |
| degree Fahrenheit                           | F or $^{\circ}$   |
| degree Kelvin                               | K or none   |
| degree of crystallinity                     | $\alpha$  |
| degree of polymerization                    | X   |
| degree Réaumur                              | R   |
| delta amplitude, an elliptic function       | dn  |
| depolymerization temperature                | $T_{dp}$  |
| density                                     | $\rho$  |
| diameter                                    | diam  |
| Dictionary of Architecture and Construction | DAC   |
| diffusion coefficient                       | D   |
| dipole moment                               | p   |
| direct-current (as adjective)               | d-c   |
| dollar                                      | \$  |
| dozen                                       | doz   |
| dram  | dr  |
| dynamic viscosity                           | $\eta$  |
| E   | energy ( $E_k$ = kinetic energy, $E_p$ = potential energy, $E^{\ddagger}$ = energy of activation) |
| E   | electronegativity   |
| E   | modulus of elasticity, Young's modulus ( $E = \sigma_{ij}/\epsilon_{ij}$ )                        |
| E   | general property  |

| Abbreviations                         | Symbols  |
|---------------------------------------|--|
| <b>E</b>                              | electrical field strength  |
| <i>e</i>                              | elementary charge  |
| <i>e</i>                              | parameter in the Q-e copolymerization theory                         |
| <i>e</i>                              | cohesive energy density (always with an index)                       |
| edition                               | Ed.  |
| Editor, edited                        | ed.  |
| efficiency                            | eff  |
| electric                              | elec   |
| electric polarizability of a molecule | $\alpha$   |
| electrical current strength           | I  |
| electrical potential                  | V  |
| electrical resistance                 | R or X   |
| electromotive force                   | emf  |
| electronegativity                     | E  |
| elevation                             | el   |
| energy                                | E  |
| enthalpy                              | H  |
| entropy                               | S  |
| equation                              | eq   |
| equivalent weight                     | equiv wt   |
| et alii (and others)                  | et al.   |
| et cetera                             | etc.   |
| excluded volume                       | u  |
| excluded volume cluster integral      | $\beta$  |
| exempli gratia (for example)          | e.g.   |
| expansion coefficient                 | $\alpha$   |
| external                              | ext  |
| <i>F</i>                              | force  |
| <i>f</i>                              | fraction (excluding molar fraction, mass fraction, volume fraction)  |
| <i>f</i>                              | molecular coefficient of friction (e.g., $f_s$ , $f_D$ , $f_{rot}$ ) |
| <i>f</i>                              | functionality  |
| farad                                 | spell out or f   |
| Federal                               | Fed.   |
| feet board measure (board feet)       | fbm  |
| feet per minute                       | fpm  |
| feet per second                       | fps  |
| flash point                           | flp  |

| Abbreviations                           | Symbols   |
|---|---|
| fluid                                   | fl  |
| foot                                    | ft  |
| foot-candle                             | ft-c  |
| foot-Lambert                            | ft-L  |
| foot-pound                              | ft-lb   |
| foot-pound-second (system)              | fps   |
| foot-second (see cubic feet per second) |   |
| fraction                                | $\int$  |
| franc                                   | fr  |
| free aboard ship                        | spell out   |
| free alongside ship                     | spell out   |
| free on board                           | fob   |
| freezing point                          | fp  |
| frequency                               | spell out   |
| fusion point                            | fnp   |
| <i>G</i>                                | Gibbs energy (formerly free energy or free enthalpy) ( $G = H - TS$ ) |
| <i>G</i>                                | shear modulus ( $G = \sigma_{ij}/\text{angle of shear}$ )             |
| <i>G</i>                                | statistical weight fraction ( $G_i = g_i/\sum_i g_i$ )                |
| <i>g</i>                                | gravitational acceleration  |
| <i>g</i>                                | statistical weight  |
| <i>g</i>                                | <i>gauche</i> conformation  |
| <i>g</i>                                | parameter for the dimensions of branched macromolecules               |
| $G^m$                                   | molar Gibbs energy  |
| gallon                                  | gal   |
| gallons per minute                      | gpm   |
| gallons per second                      | gps   |
| <i>gauche</i> conformation              | <i>g</i>  |
| Gibbs energy                            | G   |
| grain                                   | spell out   |
| gram                                    | g   |
| gram-calorie                            | g-cal   |
| greatest common divisor                 | gcd   |
| <i>H</i>                                | enthalpy  |
| $H^m$                                   | molar enthalpy  |
| <i>h</i>                                | height  |
| <i>h</i>                                | Planck constant   |
| haversine                               | hav   |

| Abbreviations                                     | Symbols   |
|---|---|
| heat  | Q   |
| heat capacity                                     | C   |
| hectare   | ha  |
| henry   | H   |
| high pressure (adjective)                         | h-p   |
| hogshead  | hhd   |
| horsepower  | hp  |
| horsepower-hour                                   | hp-hr   |
| hour  | h or hr   |
| hundred   | C   |
| hundredweight (112 lb)                            | cwt   |
| hydrogen ion concentration, negative logarithm of | pH  |
| hyperbolic cosine                                 | cosh  |
| hyperbolic sine                                   | sinh  |
| hyperbolic tangent                                | tanh  |
| <i>I</i>  | electrical current strength   |
| <i>I</i>  | radiation intensity of a system   |
| <i>i</i>  | radiation intensity of a molecule                                       |
| ibidem (in the same place)                        | ibid.   |
| id est (that is)                                  | i.e.  |
| inch  | in.   |
| inch-pound  | in-lb   |
| inches per second                                 | ips   |
| indicated horsepower                              | ihp   |
| indicated horsepower-hour                         | ihp-hr  |
| infrared  | IR  |
| inside diameter                                   | ID  |
| intermediate-pressure (adjective)                 | i-p   |
| internal  | int   |
| International Union of Pure and Applied Chemistry | IUPAC   |
| isotactic   | it  |
| <i>J</i>  | flow (of mass, volume, energy, etc.), always with a corresponding index |
| joule   | J   |
| <i>K</i>  | general constant  |
| <i>K</i>  | equilibrium constant  |
| <i>K</i>  | compression modulus ( $p = -K \Delta V/V_0$ )                           |
| <i>k</i>  | Boltzmann constant  |

| Abbreviations                | Symbols   |
|------------------------------|---|
| <i>k</i>                     | rate constant for chemical reactions (always with an index) |
| Kelvin                       | K (Not °K)  |
| kilocalorie                  | kcal  |
| kilocycles per second        | kc  |
| kilogram                     | kg  |
| kilogram-calorie             | kg-al   |
| kilogram-meter               | kg-m  |
| kilograms per cubic meter    | kg per cu m or kg/m <sup>3</sup>                            |
| kilograms per second         | kgps  |
| kiloliter                    | Kl  |
| kilometer or kilometer       | km  |
| kilometers per second        | kmps  |
| kilovolt                     | kv  |
| kilovolt-ampere              | kva   |
| kilowatt                     | kw  |
| kilowatthour                 | kwhr  |
| Knoop hardness number        | KHN   |
| <i>L</i>                     | chain end-to-end distance                                   |
| <i>L</i>                     | phenomenological coefficient                                |
| <i>l</i>                     | length  |
| lambert                      | L   |
| latitude                     | lat or $\phi$   |
| least common multiple        | lcm   |
| length                       | l   |
| linear expansion coefficient | Y   |
| linear foot                  | lin ft  |
| liquid                       | liq   |
| lira                         | spell out   |
| liter                        | l   |
| logarithm (common)           | log   |
| logarithm (natural)          | log. or ln  |
| kibgutyde                    | kibg. or $\lambda$  |
| loss angle                   | $\delta$  |
| low-pressure (as adjective)  | l-p   |
| lumen                        | 1*  |
| lumen-hour                   | 1-hr*   |
| lumens per watt              | lpw   |
| <i>M</i>                     | "molecular weight" (IUPAC molar mass)                       |
| <i>m</i>                     | mass  |
| mass                         | spell out or m  |
| mass fraction                | w   |

| Abbreviations                    | Symbols            |
|----------------------------------|--------------------|
| mathematics (ical)               | math               |
| maximum                          | max                |
| mean effective pressure          | mep                |
| mean horizontal candlepower      | mhcp               |
| meacycle                         | mHz                |
| megohm                           | MΩ                 |
| melting point, -temperature      | mp, T <sub>m</sub> |
| meter                            | m                  |
| meter-kilogram                   | m-kg               |
| metre                            | m                  |
| mho                              | spell out          |
| microspere                       | μa or mu a         |
| microfarad                       | μf                 |
| microinch                        | μin.               |
| micrometer (formerly micron)     | μm                 |
| micromicrofarad                  | μμf                |
| micromicron                      | μμ                 |
| micron                           | μ                  |
| microvolt                        | μv                 |
| microwatt                        | μw or mu w         |
| mile                             | spell out          |
| miles per hour                   | mph                |
| miles per hour per second        | mphps              |
| milli                            | m                  |
| milliampere                      | ma                 |
| milliequivalent                  | meq                |
| milligram                        | mg                 |
| millihenry                       | mh                 |
| millilambert                     | mL                 |
| milliliter or milliliter         | ml                 |
| millimeter                       | mm                 |
| millimeter or mercury (pressure) | mm Hg              |
| millimicron                      | mμ or m mu         |
| million                          | spell out          |
| million gallons per day          | mgd                |
| millivolt                        | mv                 |
| minimum                          | min                |
| minute                           | min                |
| minute (angular measure)         |                    |

| Abbreviations                                 | Symbols  |
|---|--|
| minute (time) (in astronomical tables)        | m  |
| mile  | spell out  |
| modal   | m  |
| modulus of elasticity                         | E  |
| molar   | M  |
| molar enthalpy                                | H <sub>m</sub>   |
| molar Gibbs Energy                            | G <sub>m</sub>   |
| molar heat capacity                           | C <sub>m</sub>   |
| mole  | mol  |
| mole fraction                                 | x  |
| molecular weight                              | mol wt or M  |
| month   | spell out  |
| N   | number of elementary particles (e.g., molecules, groups, atoms, electrons) |
| N <sub>L</sub>                                | Avogadro number (Loschmidt's number)                                       |
| n   | amount of a substance (mole)   |
| n   | refractive index   |
| nanometer (formerly millimicron)              | nm   |
| National Association of Corrosion Engineers   | NACE   |
| National Electrical Code                      | NEC  |
| newton  | N  |
| normal  | N  |
| number of elementary particles                | N  |
| Occupational Safety and Health Administration | OSHA   |
| ohm   | Ω  |
| ohm-centimeter                                | ohm-cm   |
| oil absorption                                | O.A.   |
| ounce   | oz   |
| once-foot                                     | oz-ft  |
| ounce-inch                                    | oz-in.   |
| outside diameter                              | OD   |
| osmotic pressure                              | Π  |
| P   | permeability of membranes  |
| p   | probability  |
| p   | dipole moment  |
| p <sub>i</sub>                                | induced dipolar moment   |
| p   | pressure   |

| Abbreviations  | Symbols   |
|--|---|
| <i>p</i>   | extent of reaction  |
| Paint Testing Manual   | PTM   |
| parameter  | Q   |
| partition function (system)  | Q   |
| parts per billion  | ppb   |
| parts per million  | ppm   |
| pascal   | Pa  |
| peck   | pk  |
| penny (pency – new British)  | p.  |
| pennyweight  | dwt   |
| per  | diagonal line in expressions with unit symbols or (see Fundamental Rules) |
| percent  | %   |
| permeability of membranes  | P   |
| peso   | spell out   |
| pint   | pt.   |
| Planck's constant (in $E = h\nu$ )<br>( $6.62517 \pm 0.00023 \times 10^{-27}$ erg sec) | h   |
| polymolecularity index   | Q   |
| potential  | spell out   |
| potential difference   | spell out   |
| pound  | lb  |
| pound-foot   | lb-ft   |
| pound-inch   | lb-in.  |
| pound sterling   | £   |
| pounds-force per square inch   | psi   |
| pounds per brake horsepower-hour   | lb per bhp-hr   |
| pounds per cubi foot   | lb per cut ft   |
| pounds per square foot   | psf   |
| pounds per square inch   | psi   |
| pounds per square inch absolute  | psia  |
| power factor   | spell out or pf   |
| pressure   | p   |
| probability  | P   |
| Q  | quantity of electricity, charge   |
| Q  | heat  |
| Q  | partition function (system)   |
| Q  | parameter in the Q-e copolymerization equation                            |

| Abbreviations                           | Symbols   |
|---|---|
| Q, Q                                    | polydispersity, polymolecularity in-dex ( $Q = \bar{M}_w/\bar{M}_n$ ) |
| q                                       | partition function (particles)  |
| quantity of electricity, charge         | Q   |
| quart                                   | qt  |
| quod vide (which see)                   | q.v.  |
| <i>R</i>                                | molar gas constant  |
| <i>R</i>                                | electrical resistance   |
| $R_G$                                   | radius of gyration  |
| $R_n$                                   | run number  |
| $R_\theta$                              | Rayleigh ratio  |
| <i>r</i>                                | radius  |
| $r_o$                                   | initial molar ratio of reactive groups in polycondensations           |
| radian                                  | spell out   |
| radius                                  | r   |
| radius of gyration                      | $R_G$   |
| rate constant                           | k   |
| Rayleigh ratio                          | $R_\theta$  |
| reactive kilovolt-ampere                | kvar  |
| reactive volt-ampere                    | var   |
| reference(s)                            | ref   |
| refractive index                        | n   |
| relaxation time                         | $\tau$  |
| resistivity                             | $\rho$  |
| revolutions per minute                  | rpm   |
| revolutions per second                  | rps   |
| rod                                     | spell out   |
| root mean square                        | rms   |
| <i>S</i>                                | entropy   |
| $S^m$                                   | molar entropy   |
| <i>S</i>                                | solubility coefficient  |
| <i>s</i>                                | sedimentation coefficient   |
| <i>s</i>                                | selectivity coefficient in osmotic measurements)                      |
| Saybolt Universal seconds               | SUS   |
| secant                                  | sec   |
| second                                  | s or sec  |
| second (angular measure)                | "   |
| second-foot (see cubic feet per second) |   |

| Abbreviations                                    | Symbols                   |
|--|---------------------------|
| second (time) (in astronomical tables)           | s                         |
| Second virial coefficient                        | $A_2$                     |
| shaft horsepower                                 | shp                       |
| shilling   | s                         |
| sine   | sin                       |
| sine of the amplitude, an elliptic function      | sn                        |
| society  | Soc.                      |
| Soluble  | sol                       |
| solubility coefficient                           | S                         |
| solubility parameter                             | $\delta$                  |
| solution   | soln                      |
| specific gravity                                 | sp gr                     |
| specific heat                                    | sp ht                     |
| specific heat capacity (formerly: specific heat) | c                         |
| specific optical rotation                        | $[\alpha]$                |
| specific volume                                  | sp vol                    |
| spherical candle power                           | scp                       |
| square   | sq                        |
| square centimeter                                | sq cm or $\text{cm}^2$    |
| square foot                                      | sq ft                     |
| square inch                                      | sq in.                    |
| square kilometer                                 | sq km or $\text{km}^2$    |
| square meter                                     | sq m or $\text{m}^2$      |
| square micron                                    | sq $\mu$ or $\mu^2$       |
| square root of mean square                       | rms                       |
| standard   | std                       |
| Standard   | Std.                      |
| Standard deviation                               | $\sigma$                  |
| Staudinger index                                 | $[\eta]$                  |
| stere  | s                         |
| syndiotactic                                     | st                        |
| $T$  | temperature               |
| $t$  | time                      |
| $t$  | <i>trans</i> conformation |
| tangent  | tan                       |
| temperature                                      | T or temp                 |
| tensile strength                                 | ts                        |
| threodiisotactic                                 | tit                       |
| thousand   | M                         |
| thousand foot-pounds                             | kip-ft                    |
| thousand pound                                   | kip                       |

| Abbreviations             | Symbols                               |
|---------------------------|---------------------------------------|
| ton                       | spell out                             |
| ton-mile                  | spell out                             |
| trans conformation        | t                                     |
| trans-tactic              | tt                                    |
| $U$                       | voltage                               |
| $U$                       | internal energy                       |
| $U^m$                     | molar internal energy                 |
| $u$                       | excluded volume                       |
| ultraviolet               | UV                                    |
| United States             | U.S.                                  |
| $V$                       | volume                                |
| $V$                       | electrical potential                  |
| $v$                       | rate, rate of reaction                |
| $v$                       | specific volume always with an in-dex |
| vapor pressure            | vp                                    |
| versed sine               | vers                                  |
| versus                    | vs                                    |
| volt                      | v or V                                |
| volt-ampere               | va                                    |
| volt-coulomb              | spell out                             |
| voltage                   | U                                     |
| volume                    | V or vol.                             |
| Volume (of a publication) | Vol                                   |
| $W$                       | weight                                |
| $W$                       | work                                  |
| $w$                       | mass function                         |
| watt                      | w or W                                |
| watthour                  | whr                                   |
| watts per candle          | wpc                                   |
| week                      | spell out                             |
| weight                    | W or w                                |
| weight concentration*     | c                                     |
| work                      | y yield                               |
| $X$                       | degree of polymerization              |
| $X$                       | electrical resistance                 |
| $x$                       | mole fractio y yield                  |
| yard                      | yd                                    |
| year                      | yr                                    |
| Young's                   | E                                     |
| $Z$                       | collision number                      |
| $Z$                       | z fraction                            |
| $z$                       | ionic charge                          |



| Abbreviations   | Symbols   |
|-----------------|---|
| z               | coordination number   |
| z               | dissymmetry (light scattering)  |
| z               | parameter in excluded volume theory   |
| $\alpha$        | angle, especially angle of rotation in optical activity   |
| $\alpha$        | cubic expansion coefficient [ $\alpha = V^{-1} (\partial V / \partial T)_p$ ]   |
| $\alpha$        | expansion coefficient (as reduced length, e.g., $\alpha_L$ in the chain end-to-end distance or $\alpha_R$ for the radius of gyration) |
| $\alpha$        | degree of crystallinity (always with an index)  |
| $\alpha$        | electric polarizability of a molecule   |
| $[\alpha]$      | "specific" optical rotation   |
| $\beta$         | angle   |
| $\beta$         | coefficient of pressure   |
| $\beta$         | excluded volume cluster integral  |
| $\Gamma$        | preferential solvation  |
| $\gamma$        | angle   |
| $\gamma$        | surface tension   |
| $\gamma$        | linear expansion coefficient  |
| $\delta$        | loss angle  |
| $\delta$        | solubility parameter  |
| $\delta$        | chemical shift  |
| $\varepsilon$   | linear expansion ( $\varepsilon = \Delta l / l_0$ )   |
| $\varepsilon$   | expectation   |
| $\varepsilon_r$ | relative permittivity (dielectric number)   |
| $\eta$          | dynamic viscosity   |
| $[\eta]$        | Staudinger index (called $J_0$ in DIN 1342)   |
| $\Theta$        | characteristic temperature, especially theta temperature  |
| $\theta$        | angle, especially angle of rotation   |
| $\vartheta$     | angle, especially valence angle   |
| $\kappa$        | isothermal compressibility [ $\kappa = V^{-1} (\partial V / \partial p)_T$ ]  |
| $\kappa$        | enthalpic interaction parameter in solution theory  |

| Abbreviations | Symbols  |
|---------------|--|
| $\lambda$     | wavelength   |
| $\lambda$     | heat conductivity  |
| $\lambda$     | degree of coupling   |
| $\mu$         | chemical potential   |
| $\mu$         | moment   |
| $\mu$         | permanent dipole moment  |
| $\nu$         | mement, with respect to a reference value  |
| $\nu$         | frequency  |
| $\nu$         | kinetic chain length   |
| $\xi$         | shielding ratio in the theory of random coils  |
| $\Xi$         | partition function   |
| $\Pi$         | osmotic pressure   |
| $\rho$        | density  |
| $\sigma$      | mechanical stress ( $\sigma_{ii}$ = normal stress, $\sigma_{ij}$ = shear stress)                     |
| $\sigma$      | standard deviation   |
| $\sigma$      | hindrance parameter  |
| $\tau$        | relaxation time  |
| $\tau_i$      | internal transmittance (transmission factor) (represents the ratio of transmitted to absorbed light) |
| $\phi$        | volume fraction  |
| $\varphi(r)$  | potential between two segments separated by a distance $r$   |
| $\Phi$        | constant in the viscosity-molecular-weight relationship  |
| $[\Phi]$      | "molar" optical rotation   |
| $\chi$        | interaction parameter in solution theory   |
| $\psi$        | entropic interaction parameter in solution theory  |
| $\omega$      | angular frequency, angular velocity  |
| $\Omega$      | angle  |
| $\Omega$      | probability  |
| $\Omega$      | skewness of a distribution   |

\* (= weight of solute divided by volume of solvent); IUPAC suggests the symbol  $\rho$  for this quantity, which could lead to confusion with the same IUPAC symbol for density.