

New Book Received *

Handbook of Polymers. By George Wypych, ChemTec Publishing, 2012; 680 Pages. Price \$395.00, ISBN 978-1-895198-47-8

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Polymers selected for this edition of the Handbook of Polymers include all major polymeric materials used by the plastics and other branches of the chemical industry as well as specialty polymers used in the electronics, pharmaceutical, medical, and space fields. Extensive information is included on biopolymers.

The data included in the Handbook of Polymers come from open literature (published articles, conference papers, and books), literature available from manufacturers of various grades of polymers, plastics, and finished products, and patent literature. The above sources were searched, including the most recent literature. It can be seen from the references that a large portion of the data comes from information published in 2011. This underscores one of the major goals of this undertaking, which is to provide readers with the most up-to-date information.

Frequently, data from different sources vary in a broad range and they have to be reconciled. In such cases, values closest to their average and values based on testing of the most current grades of materials are selected to provide readers with information which is characteristic of currently available products, focusing on the potential use of data in solving practical problems. In this process of verification many older data were rejected unless they have been confirmed by recently conducted studies.

Presentation of data for all polymers is based on a consistent pattern of data arrangement, although, depending on data availability, only data fields which contain actual values are included for each individual polymer. The entire scope of the data is divided into sections to make data comparison and search easy.

The data are organized into the following sections:

- General (Common name, IUPAC name, ACS name, Acronym, CAS number, EC number, RETECS number, Linear formula)

- History (Person to discover, Date, Details)
- Synthesis (Monomer(s) structure, Monomer(s) CAS number(s), Monomer(s) molecular weight(s), Monomer(s) expected purity(ies), Monomer ratio, Degree of substitution, Formulation example, Method of synthesis, Temperature of polymerization, Time of polymerization, Pressure of polymerization, Catalyst, Yield, Activation energy of polymerization, Free enthalpy of formation, Heat of polymerization, Initiation rate constant, Propagation rate constant, Termination rate constant, Chain transfer rate constant, Inhibition rate constant, Polymerization rate constant, Method of polymer separation, Typical impurities, Typical concentration of residual monomer, Number average molecular weight, M_n , Mass average molecular weight, M_w , Polydispersity, M_w/M_n , Polymerization degree, Molar volume at 298K, Molar volume at melting point, Van der Waals volume, Radius of gyration, End-to-end distance of unperturbed polymer chain, Degree of branching, Type of branching, Chain-end groups)
- Structure (Crystallinity, Crystalline structure, Cell type (lattice), Cell dimensions, Unit cell angles, Number of chains per unit cell, Crystallite size, Spacing between crystallites, Polymorphs, Tacticity, Cis content, Chain conformation, Entanglement molecular weight, Lamellae thickness, Heat of crystallization, Rapid crystallization temperature, Avrami constants, k/n)
- Commercial polymers (Some manufacturers, Trade names, Composition information)
- Physical properties (Density, Bulk density, Color, Refractive index, Birefringence, Molar polarizability, Transmittance, Haze, Gloss, Odor, Melting temperature, Softening point, Decomposition temperature, Fusion temperature, Thermal expansion coefficient, Thermal conductivity, Glass transition temperature, Specific heat capacity, Heat of fusion, Calorific value, Maximum service temperature, Long term service temperature, Temperature index (50% tensile strength loss after 20,000 h/5000 h), Heat deflection temperature at 0.45 MPa, Heat deflection temperature at 1.8 MPa, Vicat temperature VST/A/50, Vicat temperature VST/B/50, Start of thermal degradation, Enthalpy, Acceptor number, Donor number, Hansen solubility parameters, dD , dP , dH , Molar volume, Hildebrand solubility parameter, Surface tension, Dielectric constant at 100 Hz/1 MHz, Dielectric loss factor at 1 kHz, Relative permittivity at 100 Hz, Relative permittivity at 1 MHz, Dissipation factor at 100 Hz, Dissipation factor at 1 MHz, Volume resistivity, Surface resistivity, Electric strength K20/P50, $d = 0.60.8$ mm, Comparative tracking index, CTI, test liquid A, Comparative tracking index, CTIM, test liquid B, Arc resistance, Power factor, Coefficient of friction, Permeability to nitrogen, Permeability to oxygen, Permeability to water vapor, Diffusion coefficient of nitrogen, Diffusion coefficient of oxygen, Diffusion coefficient of water vapor, Contact angle of water, Surface free energy, Speed of sound, Acoustic impedance, Attenuation)
- Mechanical properties (Tensile strength, Tensile modulus, Tensile stress at yield, Tensile creep modulus, 1000 h, elongation 0.5 max, Elongation, Tensile yield strain, Flexural strength, Flexural modulus, Elastic modulus, Compressive strength, Young's modulus, Tear strength, Charpy impact strength, Charpy impact strength, notched, Izod impact strength, Izod impact

strength, notched, Shear strength, Tenacity, Abrasion resistance, Adhesive bond strength, Poisson's ratio, Compression set, Shore A hardness, Shore D hardness, Rockwell hardness, Ball indentation hardness at 358 N/30 S, Shrinkage, Brittleness temperature, Viscosity number, Intrinsic viscosity, Mooney viscosity, Melt viscosity, shear rate = 1000 s^{-1} , Melt volume flow rate, Melt index, Water absorption, Moisture absorption)

- Chemical resistance (Acid dilute/concentrated, Alcohols, Alkalis, Aliphatic hydrocarbons, Aromatic hydrocarbons, Esters, Greases & oils, Halogenated hydrocarbons, Ketones, Theta solvent, Good solvent, Non-solvent)
- Flammability (Flammability according to UL-standard; thickness 1.6/0.8 mm, Ignition temperature, Autoignition temperature, Limiting oxygen index, Heat release, NBS smoke chamber, Burning rate (Flame spread rate), Char, Heat of combustion, Volatile products of combustion)
- Weather stability (Spectral sensitivity, Activation wavelengths, Excitation wavelengths, Emission wavelengths, Activation energy of photooxidation, Depth of UV penetration, Important initiators and accelerators, Products of degradation, Stabilizers)
- Biodegradation (Typical biodegradants, Stabilizers)
- Toxicity (NFPA: Health, Flammability, Reactivity rating, Carcinogenic effect, Mutagenic effect, Teratogenic effect, Reproductive toxicity, TLV, ACGIH, NIOSH, MAK/TRK, OSHA, Acceptable daily intake, Oral rat, LD50, Skin rabbit, LD50)
- Environmental impact (Aquatic toxicity, Daphnia magna, LC50, 48 h, Aquatic toxicity, Bluegill sunfish, LC50, 48 h, Aquatic toxicity, Fathead minnow, LC50, 48 h, Aquatic toxicity, Rainbow trout, LC50, 48 h, Mean degradation half-life, Toxic products of degradation, Biological oxygen demand, BOD5, Chemical oxygen demand, Theoretical oxygen demand, Cradle to grave non-renewable energy use)
- Processing (Typical processing methods, Preprocess drying: temperature/time/residual moisture, Processing temperature, Processing pressure, Process time, Additives used in final products, Applications, Outstanding properties)
- Blends (Suitable polymers, Compatibilizers)
- Analysis (FTIR (wavenumber-assignment), Raman (wavenumber-assignment), NMR (chemical shifts), X-ray diffraction peaks)

It can be anticipated from the above breakdown of information that the Handbook of Polymers contains information on all essential data used in practical applications, research, and legislation, providing such data are available for a particular material. In total, over 230 different types of data were searched for each individual polymer. The last number does not include special fields that might be added to characterize the performance of specialty polymers in their applications.

We hope that the results of our thorough search will be useful and that the data will be skillfully applied by users of this book for the benefit of their research and applications.

The contents, scope, treatment of the data (comparison of data from different sources and their qualification), and novelty of the data give the book which should be found on desk of anyone working with polymeric materials.

Table of Contents

Introduction

| | |
|--------|--|
| ABS | poly(acrylonitrile-co-butadiene-co-styrene) |
| AK | alkyd resin |
| ASA | poly(acrylonitrile-co-styrene-co-acrylate) |
| BIIR | bromobutyl rubber |
| BMI | polybismaleimide |
| BZ | polybenzoxazine |
| C | cellulose |
| CA | cellulose acetate |
| CAB | cellulose acetate butyrate |
| CAP | cellulose acetate propionate |
| CAPh | cellulose acetate phthalate |
| CAR | carrageenan |
| CB | cellulose butyrate |
| CEC | carboxylated ethylene copolymer |
| CHI | chitosan |
| CIIR | chlorobutyl rubber |
| CMC | carboxymethyl cellulose |
| CN | cellulose nitrate |
| COC | cyclic olefin copolymer |
| CPE | polyethylene, chlorinated |
| CPVC | poly(vinyl chloride), chlorinated |
| CR | polychloroprene |
| CSP | polyethylene, chlorosulfonated |
| CTA | cellulose triacetate |
| CY | cyanoacrylate |
| DAP | poly(diallyl phthalate) |
| E-RLPO | poly(ethyl acrylate-co-methyl methacrylate-co-triammonioethyl methacrylate chloride) |
| EAA | poly(ethylene-co-acrylic acid) |
| EAMM | poly(ethyl acrylate-co-methyl methacrylate) |
| EBAC | poly(ethylene-co-butyl acrylate) |
| EBCO | ethylene-n-butyl acrylate-carbon monoxide terpolymer |
| EC | ethyl cellulose |
| ECTFE | poly(ethylene-co-chlorotrifluoroethylene) |
| EEAC | poly(ethylene-co-ethyl acrylate) |

| | |
|----------|--|
| EMA | poly(ethylene-co-methyl acrylate) |
| EMA-AA | poly(ethylene-co-methyl acrylate-co-acrylic acid) |
| ENBA | poly(ethylene-co-n-butyl acrylate) |
| EP | epoxy resin |
| EPDM | ethylene-propylene diene terpolymer |
| EPR | ethylene propylene rubber |
| ETFE | poly(ethylene-co-tetrafluoroethylene) |
| EVAC | ethylene-vinyl acetate copolymer |
| EVOH | ethylene-vinyl alcohol copolymer |
| FEP | fluorinated ethylene-propylene copolymer |
| FR | furan resin |
| GEL | gelatin |
| GT | gum tragacanth |
| HCP | hydroxypropyl cellulose |
| HDPE | high density polyethylene |
| HEC | hydroxyethyl cellulose |
| HPMC | hydroxypropyl methylcellulose |
| HPMM | poly(methacrylic acid-co-methyl methacrylate) |
| IIR | isobutylene-isoprene rubber |
| LCP | liquid crystalline polymers |
| LDPE | low density polyethylene |
| LLDPE | linear low density polyethylene |
| MABS | poly(methyl methacrylate-co-acrylonitrile-co-butadiene-co-styrene) |
| MBS | poly(styrene-co-butadiene-co-methyl methacrylate) |
| MC | methylcellulose |
| MF | melamine-formaldehyde resin |
| MP | melamine-phenolic resin |
| NBR | acrylonitrile-butadiene elastomer |
| PA-3 | polyamide-3 |
| PA-4,6 | polyamide-4,6 |
| PA-4,10 | polyamide-4,10 |
| PA-6 | polyamide-6 |
| PA-6,6 | polyamide-6,6 |
| PA-6,10 | polyamide-6,10 |
| PA-6,12 | polyamide-6,12 |
| PA-6,66 | polyamide-6,66 |
| PA-6I/6T | |
| PA-11 | polyamide-11 |
| PA-12 | polyamide-12 |
| PAA | poly(acrylic acid) |
| PAAm | polyacrylamide |
| PAC | polyacetylene |

| | |
|-----------|--|
| PAEK | acrylonitrile-butadiene-acrylate copolymer |
| PAH | polyanhydride |
| PAI | poly(amide imide) |
| Palg | alginic acid |
| PAN | polyacrylonitrile |
| PANI | polyaniline |
| PAR | polyarylate |
| PARA | polyamide MXD6 |
| PB | 1,2-polybutylene |
| PBA | poly(p-benzamide) |
| PBAN | poly(butadiene-co-acrylonitrile-co-acrylic acid) |
| PBD,cis | cis-1,4-polybutadiene |
| PBD,trans | |
| PBI | polybenzimidazole |
| PBMA | polybutylmethacrylate |
| PBN | poly(butylene 2,6-naphthalate) |
| PBT | poly(butylene terephthalate) |
| PC | polycarbonate |
| PCL | poly(ϵ -caprolactone) |
| PCT | poly(cyclohexylene terephthalate) |
| PCTFE | polychlorotrifluoroethylene |
| PCTG | poly(ethylene-co-1,4-cyclohexylenedimethylene terephthalate) |
| PDMS | polydimethylsiloxane |
| PDS | polydioxanone |
| PE | polyethylene |
| PEA | poly(ethyl acrylate) |
| PEC | poly(ester carbonate) |
| PEDOT | poly(3,4-ethylenedioxythiophene) |
| PEEK | polyetheretherketone |
| PEI | poly(ether imide) |
| PEK | polyetherketone |
| PEKK | polyetherketoneketone |
| PEM | poly(ethylene-co-methacrylic acid) |
| PEN | poly(ethylene 2,6-naphthalate) |
| PEO | poly(ethylene oxide) |
| PES | poly(ether sulfone) |
| PET | poly(ethylene terephthalate) |
| PEX | silane-crosslinkable polyethylene |
| PF | phenol-formaldehyde resin |
| PFA | perfluoroalkoxy resin |
| PFI | perfluorinated ionomer |
| PFPE | perfluoropolyether |

| | |
|-----------|--|
| PGA | poly(glycolic acid) |
| PHEMA | poly(2-hydroxyethyl methacrylate) |
| PHB | poly(3-hydroxybutyrate) |
| PHSQ | polyhydridosilsesquioxane |
| PI | polyimide |
| PIB | polyisobutylene |
| PIP,cis | cis-polyisoprene |
| PIP,trans | |
| PK | polyketone |
| PLA | poly(lactic acid) |
| PMA | poly(methyl acrylate) |
| PMAA | poly(methacrylic acid) |
| PMAN | polymethacrylonitrile |
| PMFS | polymethyltrifluoropropylsiloxane |
| PMMA | polymethylmethacrylate |
| PMP | polymethylpentene |
| PMPS | polymethylphenylsilylene |
| PMS | poly(p-methylstyrene) |
| PMSQ | polymethylsilsesquioxane |
| PN | polynorbornene |
| POE | very highly branched polyethylene |
| POM | polyoxymethylene |
| PP | polypropylene |
| PP,iso | polypropylene, isotactic |
| PP,syndio | |
| PPA | polyphthalamide |
| PPG | polypropylene glycol |
| PPMA | polypropylene, maleic anhydride modified |
| PPO | poly(phenylene oxide) |
| PPP | poly(1,4-phenylene) |
| PPS | poly(p-phenylene sulfide) |
| PPSQ | polyphenylsilsesquioxane |
| PPSU | poly(phenylene sulfone) |
| PPT | poly(propylene terephthalate) |
| PPTA | poly(p-phenylene terephthalamide) |
| PPTI | poly(m-phenylene isophthalamide) |
| PPV | poly(1,4-phenylene vinylene) |
| PPX | poly(p-xylylene) |
| PPy | polypyrrole |
| PR | proteins |
| PS | polystyrene |
| PS,iso | polystyrene, isotactic |

| | |
|----------|--|
| PS,trans | polystyrene, syndiotactic |
| PSM | polysilylenemethylene |
| PSMS | poly(styrene-co-a-methylstyrene) |
| PSR | polysulfide |
| PSU | polysulfone |
| PTFE | polytetrafluoroethylene |
| PTFE-AF | |
| PTMG | poly(tetramethylene glycol) |
| PTT | poly(trimethylene terephthalate) |
| PU | polyurethane |
| PVAC | poly(vinyl acetate) |
| PVB | poly(vinyl butyrate) |
| PVC | poly(vinyl chloride) |
| PVCA | poly(vinyl chloride-co-vinyl acetate) |
| PVDC | poly(vinylidene chloride) |
| PVDF | poly(vinylidene fluoride) |
| PVDF-HFP | |
| PVF | poly(vinyl fluoride) |
| PVK | poly(N-vinyl carbazole) |
| PVME | poly(vinyl methyl ether) |
| PVOH | poly(vinyl alcohol) |
| PVP | poly(N-vinyl pyrrolidone) |
| PZ | polyphosphazene |
| SAN | poly(styrene-co-acrylonitrile) |
| SBC | styrene-butadiene block copolymer |
| SBR | poly(styrene-co-butadiene) |
| SBS | styrene-butadiene-styrene triblock copolymer |
| SEBS | styrene-ethylene-butylene-styrene triblock copolymer |
| SIS | styrene-isoprene-styrene block copolymer |
| SMA | poly(styrene-co-maleic anhydride) |
| SMAA | poly(styrene-co-methylmethacrylate) |
| ST | starch |
| TPU | thermoplastic polyurethane |
| UF | urea formaldehyde resin |
| UHMWPE | |
| ULDPE | ultralow density polyethylene |
| UP | unsaturated polyester |
| VE | vinyl ester resin |
| XG | xanthan gum |

* *Editor's Note*: The brief summary and the contents of the books are reported as provided by the author or the publishers. Authors and publishers are encouraged to send review copies of their recent books of potential interest to readers of *Polymers* to the Publisher (Dr. Shu-Kun Lin, Multidisciplinary Digital Publishing Institute (MDPI), Kandererstrasse 25, CH-4057 Basel, Switzerland. Tel.: +41-61-683-77-34; Fax: +41-61-302-89-18; E-Mail: lin@mdpi.com). Some books will be offered to the scholarly community for the purpose of preparing full-length reviews.

Note

1. The website for this book is: <http://www.chemtec.org/proddetail.php?prod=978-1-895198-47-8>.

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