

A Polymer Information Primer

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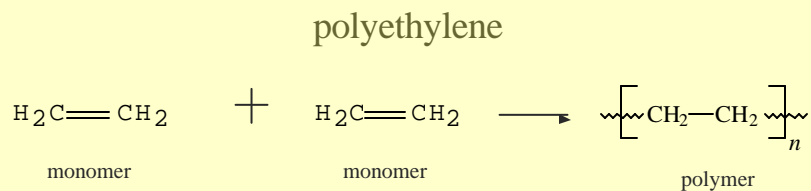
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Agenda

- What are polymers? What's their significance?
- Resources for educating yourself
- Trade Magazines & the Nuggets therein
- Societies & Organizations
- Websites
- Favorite Databases

What is a polymer?

A polymer is a substance whose molecules consist of many (poly-) units (meros) joined to each other by chemical bonds



The word polymer is derived from the Greek language.

Each unit or molecule is referred to as a monomer (mono + mer)

A polymer is represented on paper as $-[M]-n$, where the substance in the parenthesis is the repeating unit of the polymer, n is the number of repeating units, which would represent the degree of polymerization. The larger the number n , the larger the size of the polymer.

The larger the number of units, the stronger or stiffer the polymer will be. Most polymers of interest have several hundred or thousand repeating units since many applications require a polymer with a higher degree of strength.

Polymers can contain only one type of monomer (homopolymers), like polyethylene, from which plastic grocery bags, toys and pipes are made or they can be made up of different types of monomers (copolymers), such as the polymer that constitutes most of your tires, styrene-butadiene copolymer

Types of Polymers

- Thermoplastic
 - softens when exposed to heat; returns to original condition when cooled
 - polyvinylchloride, polypropylene, polystyrene
- Thermoset
 - solidifies or sets irreversibly when heated
 - rubber, polyesters, silicones

One of the ways polymers can be differentiated is by their thermal behavior. The two types of polymers differentiated in this way are thermoplastics and thermosets.

For purposes of this talk, I'm mainly concentrating on these two types of polymers. There are other types, such as biopolymers, cellulose polymers, inorganic polymers. I won't be covering those types.

More about polymers

- Polymers form the basis for
 - plastics
 - rubber
 - coatings
 - fiber
 - adhesives
 - paints
- To create the final product
 - polymerization process
 - additives
 - processing (mixing, extrusion, calendaring)
 - assembly or building
 - vulcanization or curing

Polymers are the starting point for many very important commercial products.

But those products aren't just standalone polymers. Much goes into the process of creating a final polymer product. Just in making a tire, the polymer goes through a very complicated series of steps, each one a very finely tuned process (very much a science unto itself) on the way to producing the final product.

So as an information professional, a need to find info related to this industry could crop up every now and then, since polymers touch so many areas of our lives these days. And you may be required to find out about more than the polymer itself, but possibly some of these other areas mentioned here that all go into the process of creating the final product.

Resources for educating yourself

.org and .edu websites for basic polymer information:

- The American Plastics Council web site
http://www.americanplasticscouncil.org/benefits/about_plastics/primer.html &
<http://www.teachingplastics.org/>
- The International Institute of Synthetic Rubber Producers
<http://www.iisrp.org/synthetic-rubber.html>
- Polymer and Liquid Crystal Institute Virtual textbook
<http://abalone.cwru.edu/tutorial/enhanced/files/hindex.html>

There are several websites with some good basic polymer resources for educating yourself if you don't have access to some of the better known encyclopedias or handbooks.

The American Plastics Council web site has quite a bit of educational material on polymers and plastics as well as classroom activities for teachers of elementary and junior high age students.

The International Institute of Synthetic Rubber Producers has a very good section on different types of synthetic rubber, including some industry and market statistics.

Case Western University's Polymer & Liquid Crystal Institute Virtual Handbook has a good section on basic polymers.

Resources for educating yourself

.org and .edu websites for basic polymer information:

- General Chemistry Resources: Polymer chemistry
<http://antoine.frostburg.edu/chem/senese/101/polymer/resources.shtml>,
Frostburg State University
- Polymer Chemistry Hypertext, <http://web.umr.edu/~wlf/>,
University of Missouri - Rolla
- Polymers on the Web
http://www.polymer.uakron.edu/weblinks/poly_web.html, University of
Akron

Frostburg State University has an educational tool called "Antoine" to deliver physical science education

The Polymer Chemistry Hypertext from the Univ of Missouri-Rolla is another polymer education resource.

The University of Akron has a "Polymers on the Web" dedicated to learning about polymers.

Resources for educating yourself

- Encyclopedias / Handbooks / Dictionaries
 - Kirk-Othmer Encyclopedia of Chemical Technology
 - Mark's Encyclopedia of Polymer Science and Technology
 - Polymer Science Dictionary, Elsevier (out of print), Dictionary of Plastics and Polymers, 2002 currently in Elsevier's catalog
 - Glossary of Basic Terms in Polymer Science
http://mat.ethz.ch/d-werk/suter/bt_frames.html, Inst of Polymers, Switzerland

Kirk-Othmer's and Mark's Encyclopedias are both published by Wiley. If you can get your hands on either one of these, they are an excellent resource for both novices / laymen and experts alike. Topics are explained in a very straightforward, easy to understand manner and there are always plenty of references at the end for further research.

Elsevier's Polymer Science dictionary is one I like. We have the 1989 edition, but it's now out of print. Elsevier has a 2002 dictionary of Plastics and Polymers in their catalog now - I checked it out on the exhibition floor and it's good. I like these two because they give two or three paragraphs of information vs the 2-line super short version. So you get a little more in-depth explanation of the topic.

Trade Journals

- Modern Plastics
 - Resins Report, Feb
- Plastics News, <http://www.plasticsnews.com>
 - Rankings & Lists, Special Reports, FYI Charts - on web site
- Plastics & Rubber Weekly
 - Focus On.... articles
 - Plastics Industry Awards, May
- Rubber & Plastics News, <http://www.rubbernews.com>
 - Rubber Industry Rankings, Global Tire Report - on web site

The trade journals are a great source of industry and trade information.

Many of them publish a Buyers Guide listing suppliers, products, tradenames.

Most have special issues where industry statistics or special reports are published.

Trade Journals

- Rubber World
 - Compounding Ingredients Price list - Feb & Sept
- European Rubber Journal, <http://www.crain.co.uk/erj/index.asp>
 - Global Tyre Report - November iss
- Chemical & Engineering News, <http://pubs.acs.org/cen>
 - Chemical R&D spending, Feb
 - Top 75 US Chemical Producers Report, May
 - Comparison of Global Chemical producers, July
 - Industry Facts and Figures, June
 - R&D Facts & Figures, Oct
 - Chemical Capital Spending, Dec

Societies & Organizations

- Society of Plastics Engineers, <http://www.4spe.org>
 - industry expert database
- Society of the Plastics Industry, <http://www.plasticsindustry.org/>
 - has Information Center available to the public
- American Plastics Council, <http://www.americanplasticscouncil.org/>
 - Excellent source of info on plastics and health & plastics and the environment
 - Plastics Industry Statistics

Societies and Organizations can be a good source of information too. Many of them publish books & journals. They sponsor and publish conferences and proceedings. Most of them have links on their websites to other sources of info in the industry

SPE's web site has a find an industry expert link that takes you to a searchable index of consultants in various specialties.

SPI has an information center available and open to the public, as well as historical and educational materials.

The APC is a wealth of good information related to health and the environment ranging from educational materials to a database of recycled plastics manufactures and .

they also publish plastics industry statistics on their web site.

More Societies and Organizations

- IISRP, Int'l Institute of Synthetic Rubber Producers, <http://www.iisrp.com/>
 - publish “Worldwide Rubber Statistics” and the “Synthetic Rubber Manual”
- Rubber Manufacturers Assn, <http://www.rma.org>
 - publish market data on tires, natural & synthetic rubber

IISRP publishes two very valuable books for the rubber industry, the Worldwide Rubber Statistics and the Synthetic Rubber Manual. The Synth Rubb Manual tabulates the different types of synth rubber, their producers, methods of manufacture and general physical & chemical properties.

The American Chemical Society

Industry Web Sites

Plastics.com →

- Industry News
- Industry Events
- Suppliers
- Tradenames
- Definitions
- Acronyms



Plastics Technology Materials Selection Database

- search for plastics materials by a variety of ways



<http://www.plasticstechnology.com/dp/materials/>

Indispensable Reference Books

- Polymer Handbook, Wiley
 - physical constants, data & properties
- AIP Physical Properties of Polymers Handbook
- Vanderbilt Rubber Handbook
 - everything A-Z on rubber
- Hawley's Condensed Chemical Dictionary

Favorite Databases - Technical

- Chemical Abstracts
 - excellent indexing / excellent coverage
 - structure searching
- Rapra - Rubber and Plastics Research Assn
 - use category codes and thesaurus terms
- Derwent World Patents Index
 - enhanced polymer indexing valuable
- Science Citation Index

Favorite Databases - Business

- Chemical Industry Notes
- Chemical Business Newsbase
- Rapra
- Promt / Trade and Industry Database / IAC
Insite
- SRI Chemical Economics Handbook