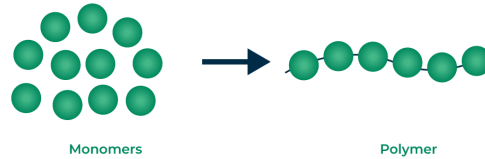


What Are Polymers?

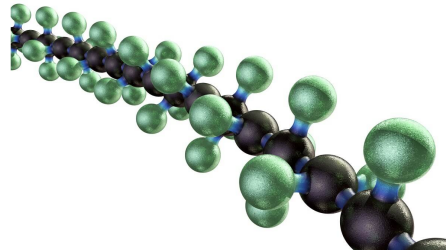
Polymers are long chains of repeating molecules.

Polymerization



Google. (n.d.). *Polymers* [Image search]. Retrieved June 16, 2025, from <https://www.google.com/imghp>.

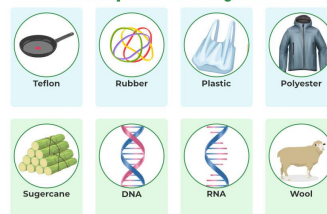
Like beads on a necklace - the beads are the repeating parts.



Perkins, S. (2017, October 13). *Explainer: What are polymers?* Cosmos. Retrieved June 16, 2025, from <https://cosmosmagazine.com/science/explainer-what-is-a-polymer>.

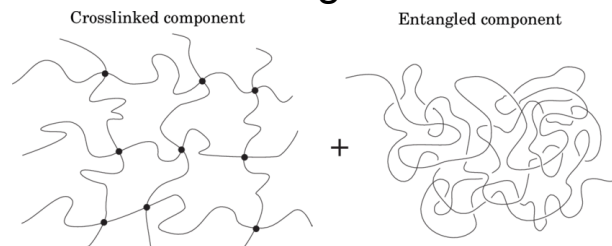
They can be natural like DNA or man-made like plastic.

Examples of Polymers



GeeksforGeeks. (2023, July 4). *Examples of polymers* [Image]. Retrieved [today's date], from <https://www.geeksforgeeks.org/polymers>.

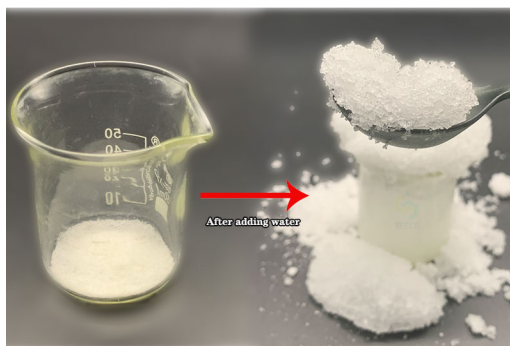
The polymer chains can be permanently linked together through bonds called cross-linking, or the polymer chains can be entangled/tangled together.



Davidson, J. (2014). *The free energy of a crosslinked, entangled network is determined by Rubinstein and Panyukov by assuming a decomposition into crosslinked and entangled components* [Figure 22]. In *Multiscale modeling and simulation of crosslinked polymers*. ResearchGate. Retrieved June 16, 2025, from https://www.researchgate.net/figure/The-free-energy-of-a-crosslinked-entangled-network-is-determined-by-Rubinstein-and_fig12_295404630.

Hydrogels

Polymers that like to hold water.
They soak up or absorb LOTS of water.
They can feel like jelly or slime.



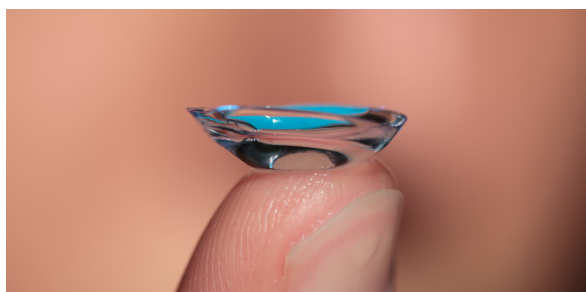
Henan SECCO Environmental Protection Technology Co., Ltd. (2021). *Industrial grade sodium polyacrylate* [Image]. Retrieved June 16, 2025, from <https://www.hnsecco.com/Industrial-grade-sodium-polyacrylate.html>.

They are used in:

- Diapers (Sodium Polyacrylate)
- Gel Bandages (Alginate)
- Gelatin
- Contact Lenses



AZoLifeSciences. (2020, February 8). *The use of natural hydrogels in food and agriculture practices*. Retrieved June 16, 2025, from <https://www.azolifesciences.com/news/20200208/The-use-of-natural-hydrogels-in-food-and-agriculture-practices.aspx>.



ContactsDirect. (n.d.). *Silicone hydrogel contact lenses* [Image]. Retrieved June 16, 2025, from <https://www.contactsdirect.com/silicone-hydrogel-contact-lenses#>.

Elastomers

SUPER STRETCHY polymers.

They can handle EXTREME HEAT and COLD.

They are bendy and flexible.

They do not crack easily.

They are used in:

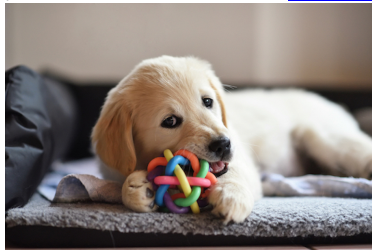
- Tires (Rubber)
- Baby Pacifiers
- Medical Tubes
- Space Suits
- Silicone



Wikipedia. (2015, April). *Elastomer: Structure of polymer chains* [Image]. Retrieved June 16, 2025, from <https://en.wikipedia.org/wiki/Elastomer>.



Timco Rubber. (2024, February 14). *Silicone vs. plastic: Material comparison*. Retrieved June 16, 2025, from <https://www.timcorubber.com/blog/archive/silicone-vs-plastic-material-comparison>.



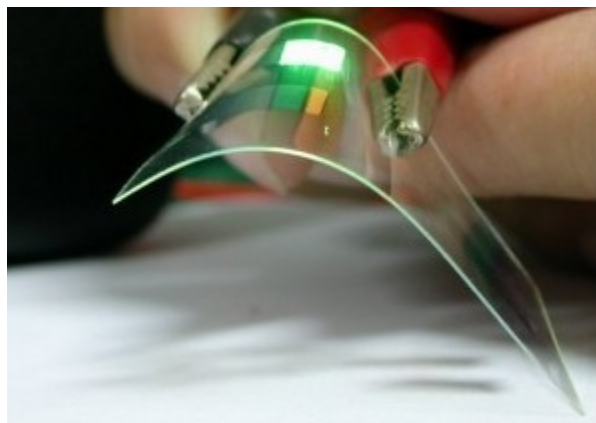
Allen, B. (2019, January 22). *Why use thermoplastic elastomer (TPE) over rubber (LSR) when manufacturing injection molds for pet toys & consumer goods*. Tech-Tank. Retrieved June 16, 2025, from <https://tech-tank.com/why-use-thermoplastic-elastomertpe-over-rubberlsr-when-manufacturing-injection-molds-for-pet-toys-consumer-goods>.

Conductive Polymers

Polymers that carry ELECTRICITY.

They are thin and bendy.

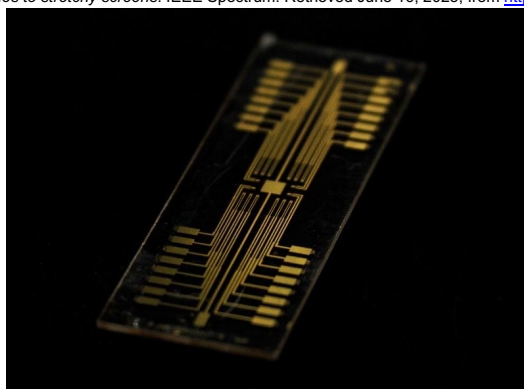
Used in touchscreens and solar panels.



Geoset. (n.d.). *Discovery and development of conductive polymers*. Retrieved June 16, 2025, from <https://www.geoset.info/presentation/discovery-and-development-of-conductive-polymers>.



Zhou, H., & Lee, T.-W. (2020, October 22). *From foldable phones to stretchy screens*. IEEE Spectrum. Retrieved June 16, 2025, from <https://spectrum.ieee.org/from-foldable-phones-to-stretchy-screens>.

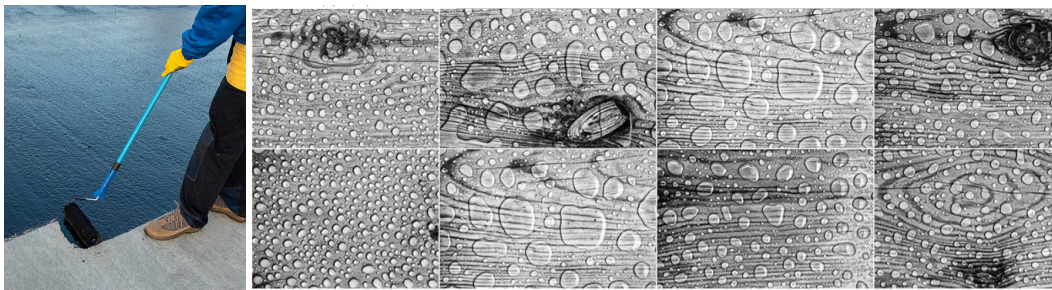


SciTechDaily. (2020, June 24). *Ion conducting polymer crucial to improving neuromorphic devices*. Retrieved June 16, 2025, from <https://scitechdaily.com/ion-conducting-polymer-crucial-to-improving-neuromorphic-devices>.

Coating Polymers

Paint that can be used for:

- 1 - Decoration
- 2 - Protection (waterproofing, corrosion, scratches)
- 3 - Special properties (non-stick or increase friction)



Gellner Industrial. (n.d.). *Polymer coatings*. Retrieved June 16, 2025, from <https://www.gellnerindustrial.com/products/polymer-coatings>.

Name:

Date:

Class:

Adhesives STICKY

Form **STRONG BONDS** between various materials like wood, metal, plastic, glass, and ceramic.



Ubuy Nepal. (n.d.). *Elmer's Glue-All, 4 oz – Multi-purpose adhesive*. Retrieved June 16, 2025, from <https://www.nepal.ubuy.com/en/product/4RYOR6Y-elmer-s-glue-all-multi-purpose-glue-4-oz>.



EcoEnclose. (n.d.). *Eco-friendly adhesives in the world of sustainable packaging*. Retrieved June 16, 2025, from <https://www.ecoenclose.com/blog/ecofriendly-adhesives-in-the-world-of-sustainable-packaging>.

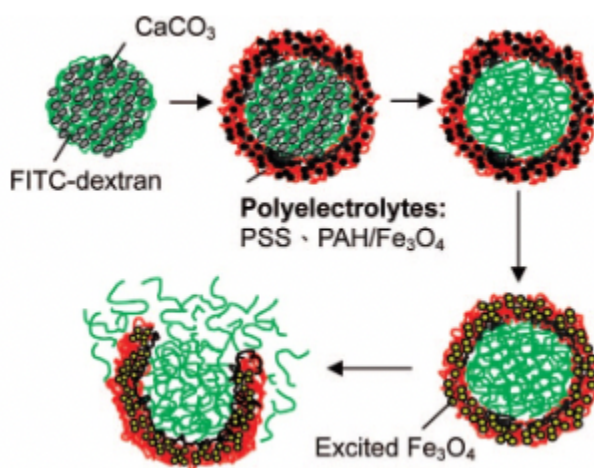
Polyelectrolytes

Polymers that can dissolve in water AND can carry or hold tiny ions.
Used to clean water or drug delivery in the body.



Bluwat Chemicals. (n.d.). *Anionic polyelectrolyte polymer for water treatment flocculation*. Retrieved June 16, 2025, from <https://bluwat01.en.made-in-china.com/product/noOQhiXUbmVj/China-Anionic-Polyelectrolyte-Polymer-for-Water-Treatment-Flocculation.html>.

Drug Delivery Example: The medicine is in green and the polymer in red.



Encyclopedia.pub. (n.d.). *History*. Retrieved June 16, 2025, from <https://encyclopedia.pub/entry/history/show/2530>.

Polymer Fibers

LONG and STRONG Polymers.

They are shaped like long threads or string.

They can be stretchy and woven into fabrics.

Used in clothes (silk, wool, polyester and Spandex/Lycra),
ropes and nets (Nylon).



Fiber Machine. (n.d.). *Difference between polyester filament and staple fiber*. Retrieved June 16, 2025, from <https://fiber-machine.com/en/difference-between-polyester-filament-and-staple-fiber>.



The Home Depot. (n.d.). *Everbilt 1/2 in. x 50 ft. White Twisted Nylon Rope*. Retrieved June 16, 2025, from <https://www.homedepot.com/p/Everbilt-1-2-in-x-50-ft-White-Twisted-Nylon-Rope-73272/206094359>.



NW Custom Apparel. (2025). *Cotton vs polyester: Finding the best fabric for your business* [Image]. Retrieved June 17, 2025, from <https://nwcustomapparel.net/wp-content/uploads/2025/01/cotton-vs-polyester-shirts.webp>.



MilitarySurplus.eu. (n.d.). *Long sleeve Lycra shirt – DEFCON 5® – Black* [Image]. Retrieved June 17, 2025, from <https://www.militarysurplus.eu/product-eng-24186-LONG-SLEEVE-LYCRA-SHIRT-DEFCON-5-R-BLACK.html>.

Composites

A mix of 2 or more materials. One is usually a polymer such as epoxy. They combine the best parts of each material such as **STRONG** and **LIGHTWEIGHT**!

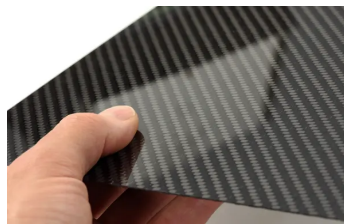
Composites are in airplanes, car parts, and skateboards.

Example: Formica



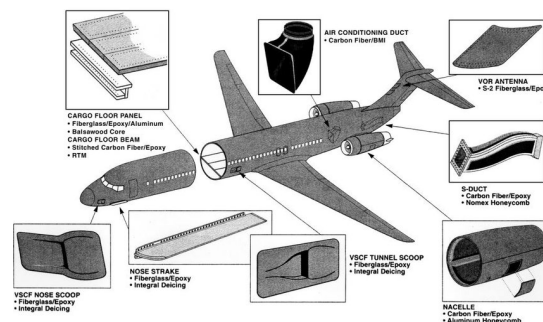
Lowe's Home Improvement. (n.d.). VT Dimensions 96 in x 25 in White Bardiglio, matte laminate countertop with integrated backsplash [Image]. Retrieved June 17, 2025, from <https://www.lowes.com/pd/VT-Dimensions-96-in-x-25-in-x-0-75-in-White-Bardiglio-9306-58-Straight-Laminate-Countertop-with-Integrated-Backsplash/5013790395>.

Example Below: Carbon/Epoxy Fiber



Google. (n.d.). Carbon/epoxy fiber [Image search result]. Retrieved June 17, 2025, from <https://images.google.com>.

Commercial Aircraft Composite Structures



Mohammed, A. G. (2014). Commercial aircraft composite structure (Courtesy of Composites Horizon Inc.) [Figure 6]. In *Experimental and numerical approach to study the mechanical behavior of the filament wound composite leaf spring*. ResearchGate. Retrieved June 17, 2025, from https://www.researchgate.net/figure/Commercial-aircraft-composite-structure-Courtesy-of-Composites-Horizon-Inc_fig6_337330958.

BROUGHT TO YOU BY

Name:

Date:

Class:

Plastic Polymers

Moldable, Solid Polymers: They can be hard, soft, clear, colorful, thin and/or thick. They are easy to shape. They are cheap and durable. They can be recycled. They float.

Name:

Date:

Class:

Polyethylene Terephthalate, PET, ♻1



RUNI A/S. (n.d.). Empty PET-bottles before compacting [Image]. Retrieved June 17, 2025, from <https://www.compactor-runi.com/compacting/plastic-containers/pet-bottles>.

Low-Density Polyethylene, LDPE ♻4



CDDL Recycling. (2025, May 13). LDPE waste collection [Image]. Retrieved June 17, 2025, from <https://cddlrecycling.co.uk/the-truth-about-ldpe-plastic-recycling>.

Polystyrene, PS, ♻6



DESU Technology (Shanghai) Co., Ltd. (2023, January 1). Polystyrene PS plastic sheet. DESU Technology. <https://desuplastic.com/polystyrene-ps-plastic-sheet>.

High-Density Polyethylene, HDPE, ♻2



FillPlas. (n.d.). Blow molding for making plastic bottles and plastic bottles. Retrieved April 20, 2025, from <https://fillplas.com/blow-molding-making-plastic-bottles-plastic-bottles>.

Polypropylene, PP, ♻5



EuP Egypt. (n.d.). PP plastic: Everything you need to know about polypropylene. Retrieved June 17, 2025, from <https://eupegypt.com/blog/pp-plastic>.

Polyvinyl Chloride, PVC, ♻3



Lowe's. (n.d.). Charlotte Pipe 1-1/2-in x 10-ft 330 Sch 40 Solidcore PVC DWV Pipe. Retrieved June 17, 2025, from <https://www.lowes.com/pd/Charlotte-Pipe-1-1-2-in-x-10-ft-330-Sch-40-Solidcore-PVC-DWV-Pipe/3133037>.