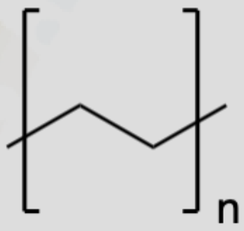
COMMON PLASTICS and SYNTHETIC RUBBERS

IUPAC
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

POLYETHYLENE (PE)

poly(methylene)

Polyethylene is the most widely produced plastic, and comes in many different forms, including high-density polyethylene (HDPE) and low-density polyethylene (LDPE). It is used in plastic bags, bottles, plastic films, piping and toys.



Discovered in **1898**

Most used plastic worldwide

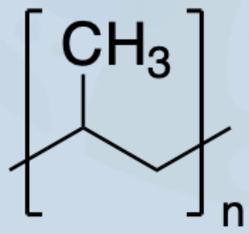
02 PE-HD

04 PE-LD

POLYPROPYLENE (PP)

poly(1-methylethylene)

Polypropylene is particularly resistant to heat, physical damage and corrosion. As a result, it is commonly used in food containers, rugs and carpets, ropes, plastic furniture, and piping. It is also used to make items for medical or laboratory use.



1st demonstration in **1951**

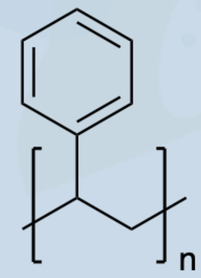
In 2020, only ≈1% of all the PP is actually recycled

05 PP

POLYSTYRENE (PS)

poly(1-phenylethylene)

Polystyrene is one of the most common plastics. It is used in its solid form for the manufacture of plastic cutlery, CD cases and disposable razors, while as a foam it is used in packaging materials, building insulation and containers for food and drink.



Discovered in **1839**

Lifespan 1000 years

06 PS

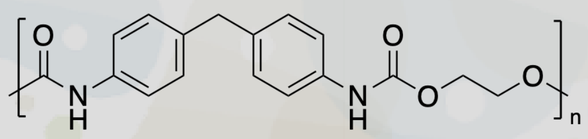
Reduce, Reuse, Recycle

three simple actions for a better future

POLYURETHANE (PU)

poly(oxyethyleneoxycarbonylazanediyl-1,4-phenylenemethylene-1,4-phenyleneazanediylcarbonyl)

Polyurethanes are another family of polymers. Their uses include foam seats (for cars and furniture), latex-free condoms, shoe soles, soccer ball coverings, wheels for skateboards and rollerblades, and some varnishes, in packaging and strips of ready meals.



Discovered in **1937**

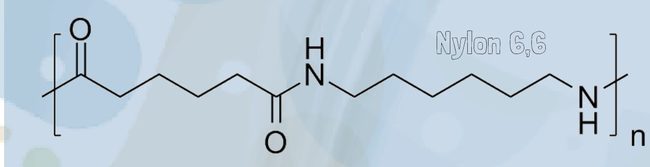
HYDROLYSABLE

(degraded by light, mushrooms)

POLYAMIDE (PA)

poly(azanediyladipoylazanediylhexane-1,6-diyl)

Polyamide (nylon) actually designates a family of polymers; nylon 6.6 is shown here. Originally, it was intended to replace synthetic silk for military applications such as parachutes. Today it is used in clothing, guitar strings and fishing lines.



Synthesized in **1935**

HYDROLYSABLE

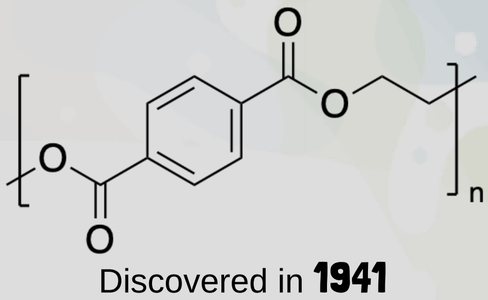
its carbon footprint is smaller than wool

PA

POLYETHYLENE TEREPHTHALATE (PET)

poly(oxyethyleneoxyterephthaloyl)

PET is a lightweight polymer and comes in different forms. It is commonly used for plastic beverage bottles, as well as for clothing fibers (where it is often referred to as "polyester"). In addition, it is used in the packaging and strips of ready meals.



Discovered in **1941**

DEGRADABLE

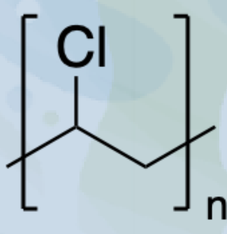
by the Nocardia bacteria

01 PET

POLYVINYL CHLORIDE (PVC)

poly(1-chloroethylene)

PVC comes in rigid and flexible forms. In its rigid form, it can be used for windows, door frames and bank cards. By adding plasticizers, it is possible to obtain a more flexible form, used for the insulation of electrical cables and as a substitute for rubber.



Discovered in **1872**

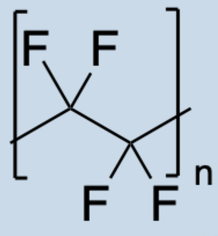
Recyclable

03 PVC

POLYTETRAFLUOROETHANE (PTFE)

poly(difluoromethylene)

The best known PTFE is Teflon. This very low reactive polymer is used in non-stick coatings on cookware. ‘Gore-Tex’ fabrics also contain PTFE-based fibers. It also has applications as a lubricant and insulator for electrical wires and cables.



Discovered in **1938**

THERMALLY DEGRADABLE

but produces harmful chemicals

07 O

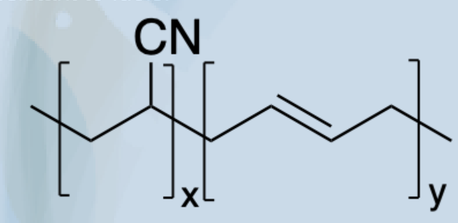
Check out our virtual version of this poster, by following this link : bit.ly/IUPACplastic

COMMON PLASTICS and SYNTHETIC RUBBER

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

POLY(ACRYLONITRILE-*CO*-BUTADIENE) (NBR)

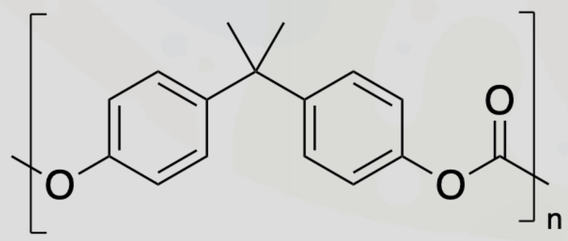
This material is a copolymer also known as NITRILE RUBBER. It is an elastomer used to make medical gloves, gaskets, cable sheathing, synthetic leather, etc.
It is resistant to fuels.



Synthesized in **1931**
VARIETY OF RUBBER
(alternative to latex for gloves)

POLYCARBONATE (PC)

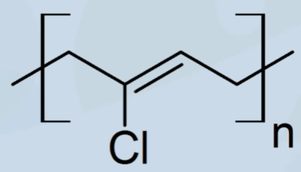
Polycarbonates are a group of thermoplastic polymers containing carbonate groups in their chemical structure. Polycarbonates are strong and tough materials, and some types are optically transparent. They are easy to work with, mould and thermoform.



Discovered in **1898**
Recyclable

POLYCHLOROPRENE (CR)

Commonly known as NEOPRENE, this family of polymers is the first example of a synthetic rubber. This plastic is highly resistant to ozone, hydrocarbons, and salt water. Guaranteeing good thermal resistance, it is widely used in the manufacture of water sports equipment such as underwater kayaking, although it is not 100% waterproof.



Developed in **1930**
Represents 3 % of the rubber market
(synthetic rubber)

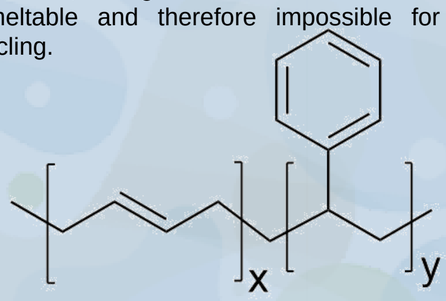
Reduce, Reuse, Recycle

three simple actions for a better future

POLY(STYRENE-co-BUTADIENE) (SBR)

poly(but-1-ene-1,4-diyl)-co-(1-phenylethylene)

This material is a copolymer also known as STYRENE-BUTADIENE RUBBER (SBR). The most common synthetic rubber. Used in tire manufacture, for gaskets, shoe soles, tubing etc. Crosslinked structure makes it un-meltable and therefore impossible for classical recycling.

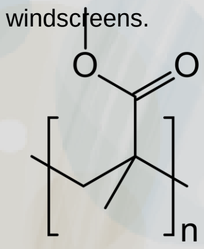


Synthesized in **1929**
MAJOR SYNTHETIC RUBBER

POLYMETHYLMETHACRYLATE (PMMA)

Poly(methyl 2-methylpropenoate)

PMMA is a transparent, strong and light thermoplastic polymer. Its best known commercial name is Plexiglass®. It has been used to manufacture lenses, safety glass and windscreens.

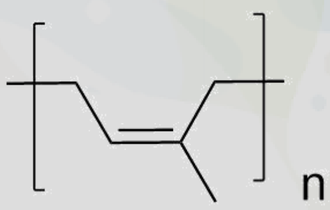


Patented in **1933**
BIOCOMPATIBLE
and degradable by cyanobacteria

POLY(cis-1,4-isoprene) (NR)

poly(2-methylbut-1-ene-1,4-diyl)

The second most used rubber. Can be made synthetically but is is more economical to collect it from latex trees grown on plantages. Properties are improved by reaction with sulfur-vulcanization. Used in tire manufacture, gaskets, tubing, gloves. Crosslinked structure makes it difficult to recycle by common way.

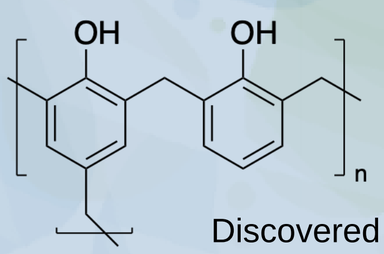


Natural polymer, in use since **1500´s**
VERY SLOW BIODEGRADATION

Phenol-formaldehyde resins

irregular polymer

Phenol-formaldehyde resins, known as Bakelites, were found by Belgian chemist Baekeland in 1906 as first synthetic plastics. It is typical example of reactoplastics, materials with high chemical and thermal resistance. Used for electrotechnical applications or parts exposed to higher temperature. It has been replaced from many original applications by cheaper and easier to process and recycle thermoplastics. Classical recycling is impossible due to densely crosslinked structure.

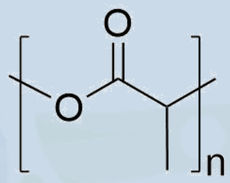


Discovered in **1906**
FIRST SYNTHETIC PLASTIC

POLY(L-LACTID ACID)

poly[oxy(1-methyl-2-oxoethylene)]

The most important bio-based synthetic plastic but currently produced only at very limited amounts (~ 0.1 % of plastics) from corn starch. Suitable for 3D printing filaments, but due to high cost and material and processing limitations, used only in small scale for packaging and textile. Difficult for classical recycling due to low thermal stability. Biodegradable but needs industrial compost to decompose in reasonable time. Presence in mixed plastics waste complicates the recycling of other major plastics.



Discovered in the **1920's**
BIODEGRADABLE