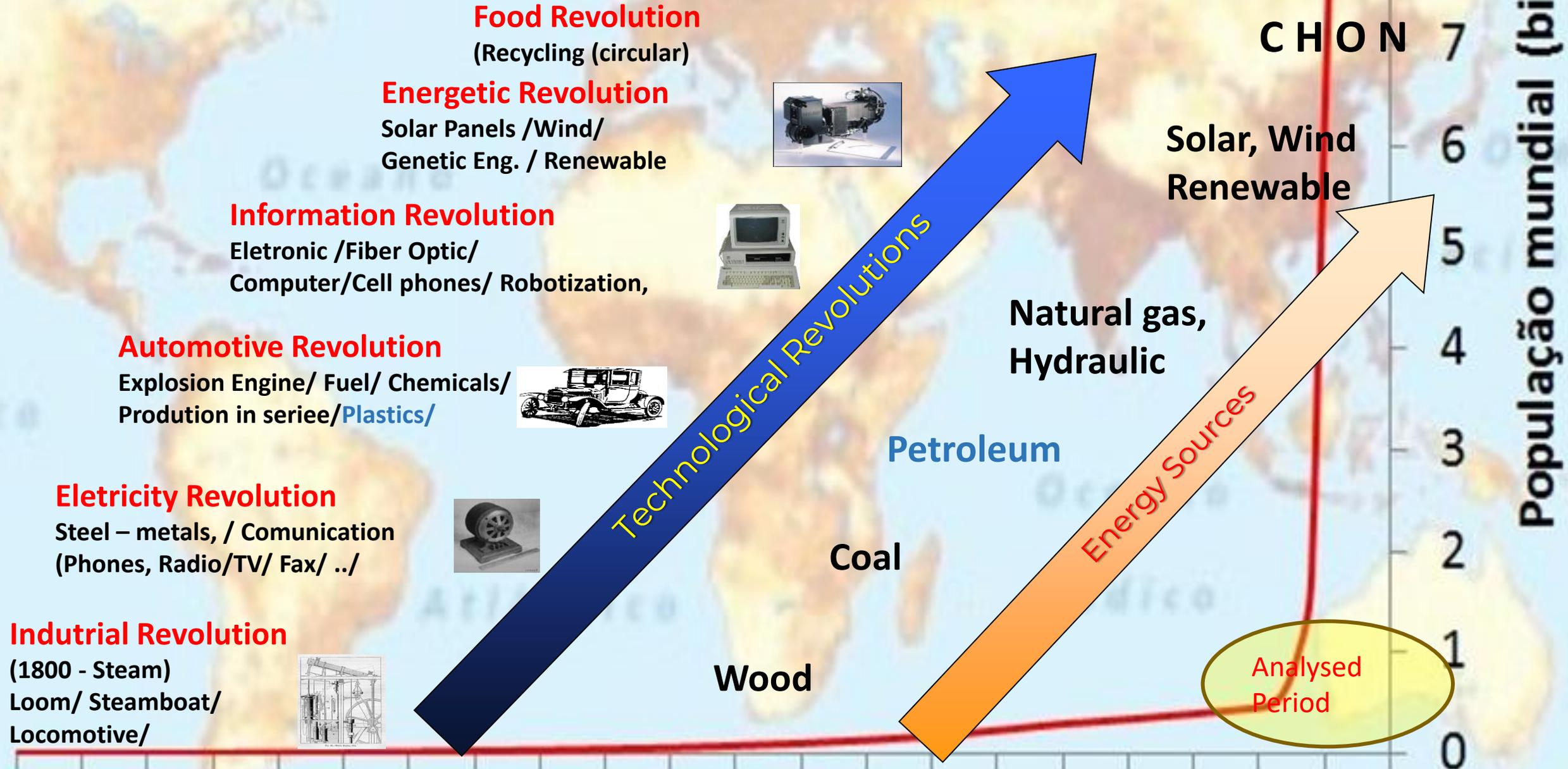


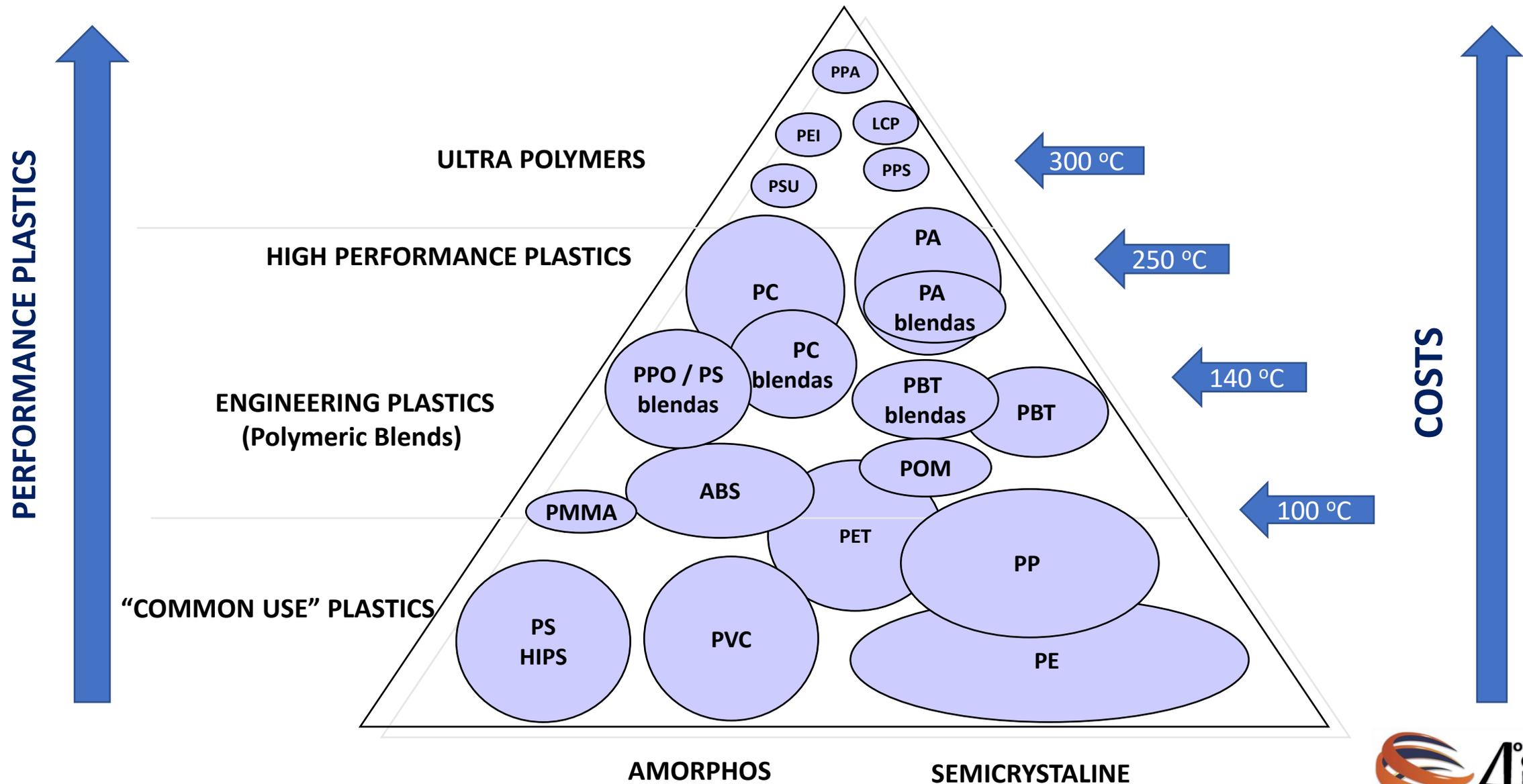
# The importance of rigid plastics and engineering plastics in peoples lives

# Modern Civilization Evolution → From 1850 ... 2020

(food, security, transport, informação ...)



# Why select plastics?

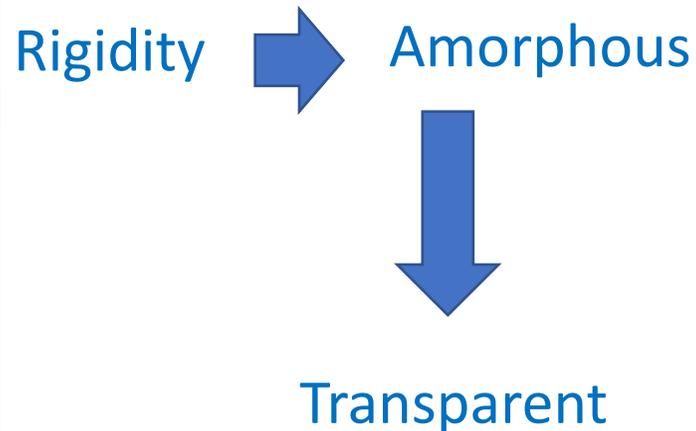


# Physical Properties- Influential Fators

Density → Transparency and

Transmittance → Refractive Index

Color → Moisture Absorption



Class	Polymer	Classification
General purpose polymers	PEBD/PEBDL	Translucent
	PEAD	Translucent to Opaque
	PP	Translucent
	PVC	Transparent
	PSGP	Transparent
	SAN	Transparent
	ABS	Opaque
	EVA	Translucent
	PMMA	Transparent
	PET	Transparent to Opaque
PSAI	Transparent to Opaque	
Engineering polymers	PC	Transparent
	PA 6	Translucent
	PA 6:6	Translucent
	POM	Opaque
	PPO	Opaque
	PBT	Opaque
	COC	Transparent
	PVDF	Transparent to Opaque
Special Engineering polymers	PPS	Opaque
	PSU	Transparent
	LCP	Opaque
	PAI	Opaque
	PEEK	Opaque
	PTFE	Opaque

The properties will be based on the standards ASTM D or ISO 1043 or ABNT or EN

# Thermal Properties

## Engineering Plastics

HDT > 100 °C

- Specific heat;
- Thermal conductivity;
- Thermal expansion;
- Characteristic transition temperature (Tg and Tm);

## Thermal Expansion

- **Expansion:** *it is evaluated by the linear thermal expansion coefficient, which is the relative elongation of the part per unit of temperature and expressed in in / in / ° F x 10-5 or cm / cm / ° C x 10-5 and can be determined by the ASTM D 696 method.*
- **Contraction:** *expressed in% in relation to the heated material. The 3 main factors that influence the contraction are: mold, injection machine and the thermoplastic material itself. Alguns exemplos: (%)*
  - ABS: 0,3 – 0,8
  - SAN: 0,2 – 0,5
  - POM: 2,5

# Defining the material

1. Understand the properties of materials
2. Quantitatively determine the requirements of the final product and classify them.
3. Determine the type of material to be used (wood, plastic, ceramic, metal, ...)
4. According to the type of material chosen above, check among them which ones meet the required requirements
5. Determine the final products requirements

# Basic phases to be followed:

## General Information

What is the function of the part?

How does the set work?

Can the use of plastic simplify the product?

Can the set be economically produced and assembled?

What is the lifespan required?

Do you want a price reduction?

Are there similar applications?

# Domestic utilities



# Home appliances



# Poly (vinyl chloride), PVC

## Properties

Light 1.4 g cm<sup>-3</sup> facilitating its handling

Resistant to most chemical reagents and to the action of fungi, bacteria, insects and rodents.

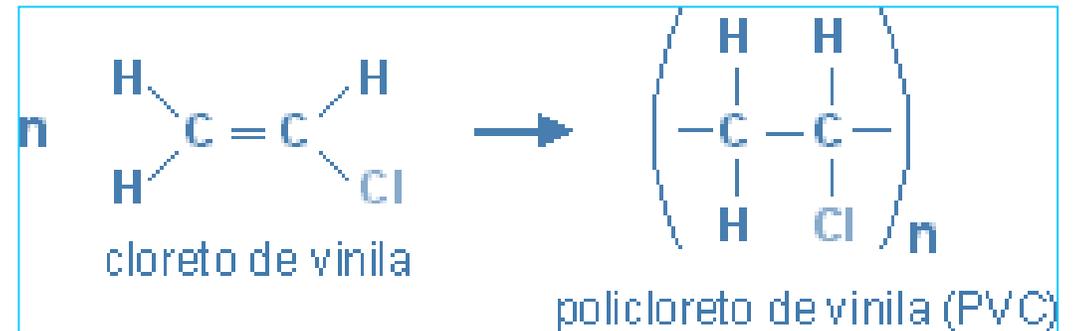
Good thermal, electrical and acoustic insulation

Solid

Shock resistant

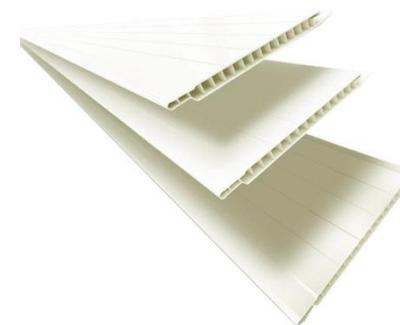
Impermeable to gases and liquids

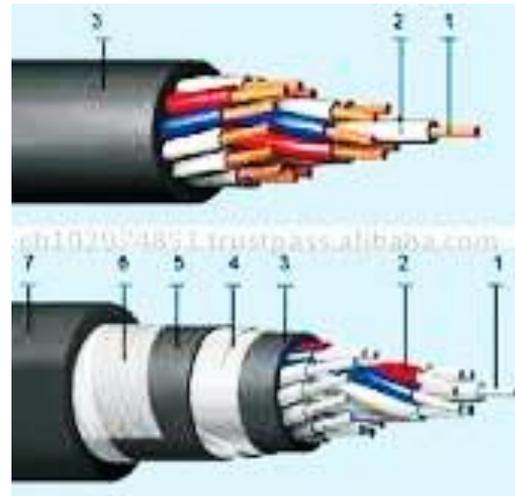
Versatile and environmentally friendly it is recyclable and recycled.



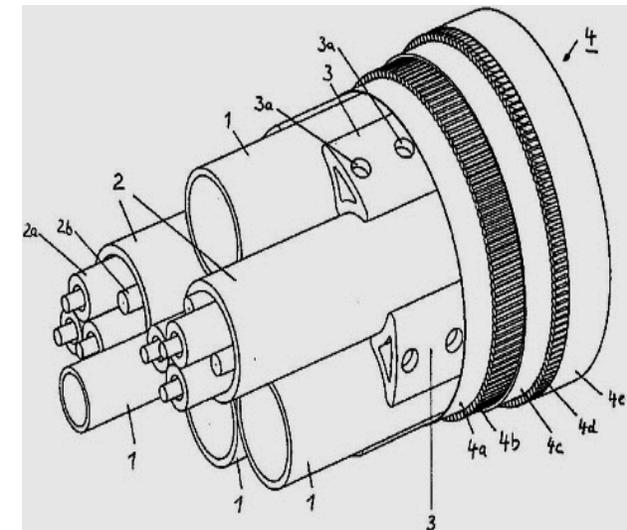
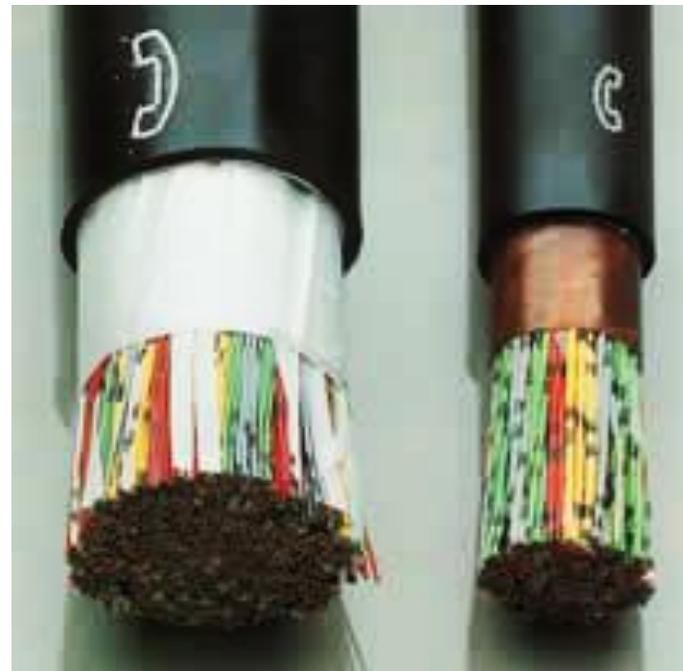
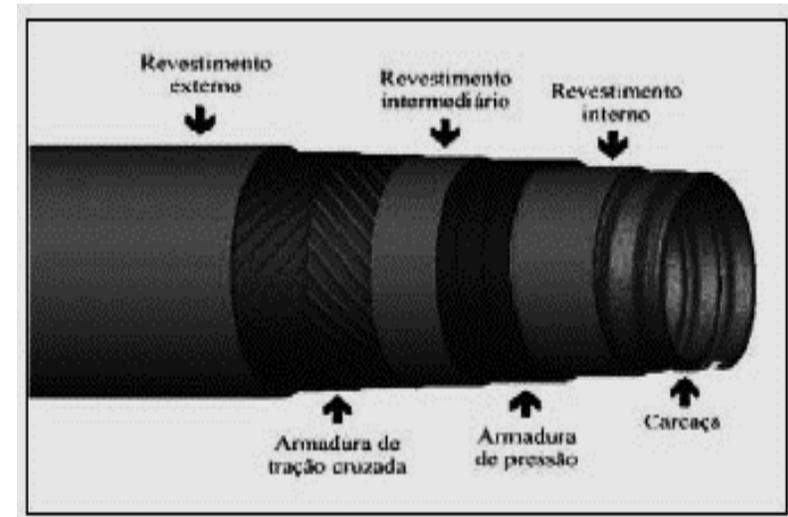
## Applications

Tubes, hoses, cable / wire coverings, profiles, window frames, rigid and flexible covers and rigid and flexible packaging for food, shoes, curtains,





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# Polystyrene, PS

## Properties

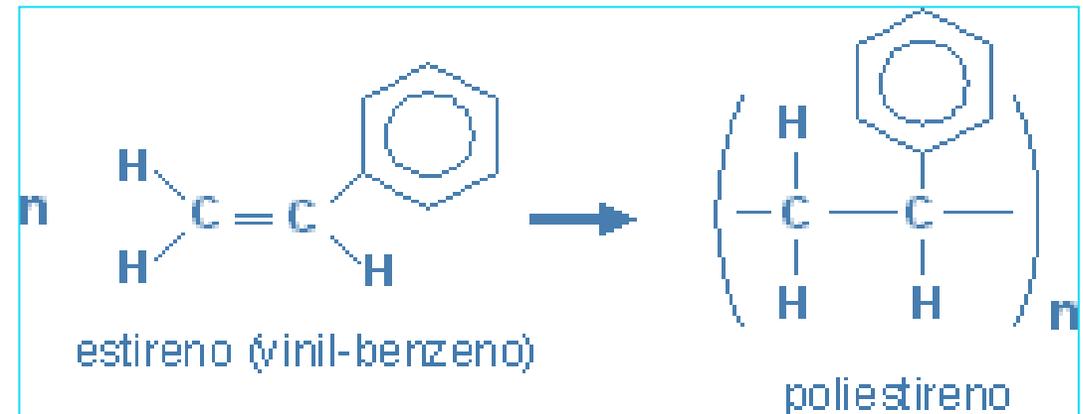
Rigidity

High chemical resistance

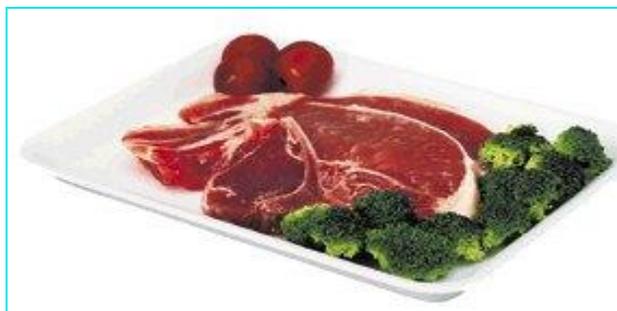
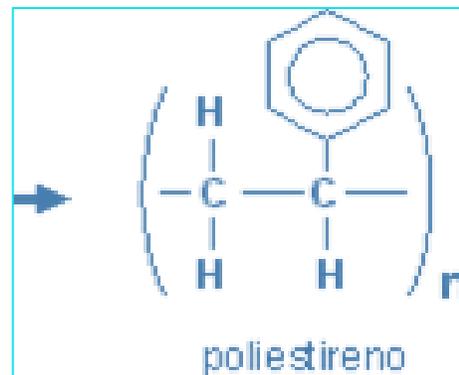
Low resistance to organic solvents

Low weather resistance

Lower cost

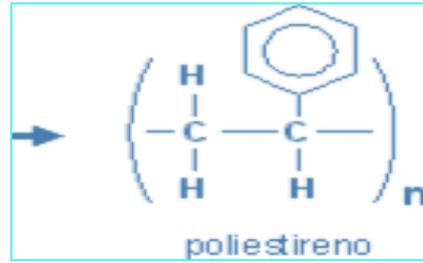


# POLYSTYRENE



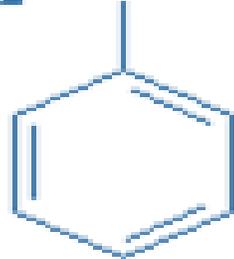
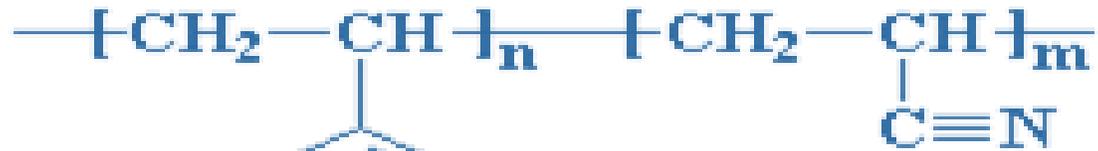


# High Impact Polystyrene PSAI



Home appliances

# Styrene Acrylonitrile SAN

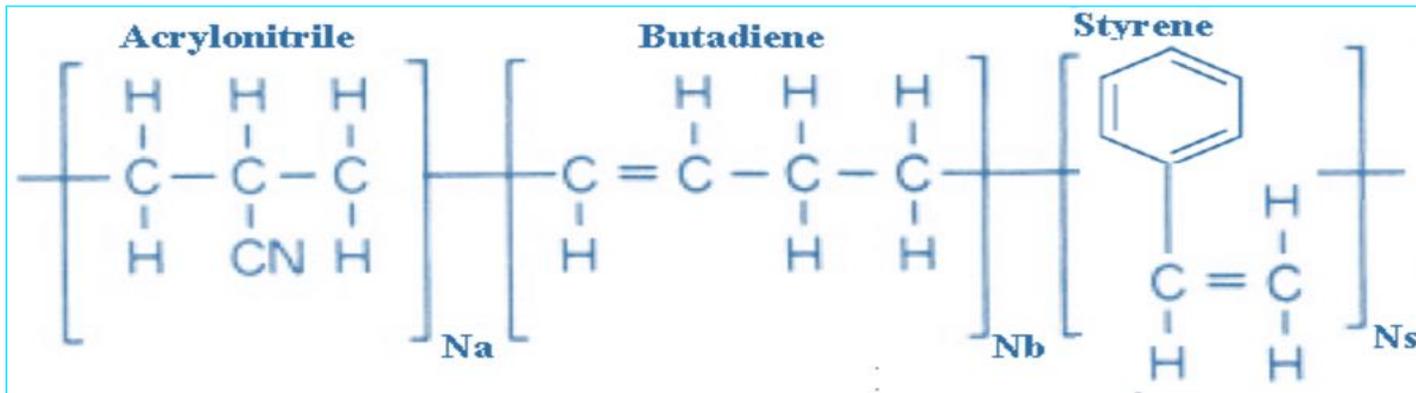


STYRENE

ACRYLONITRILE



# (Acrylonitrile Butadiene Styrene) ABS



Chemical resistance  
Scratch resistance  
Shine  
Rigidity

Impact Resistance  
Flexibility

Processability  
Low cost



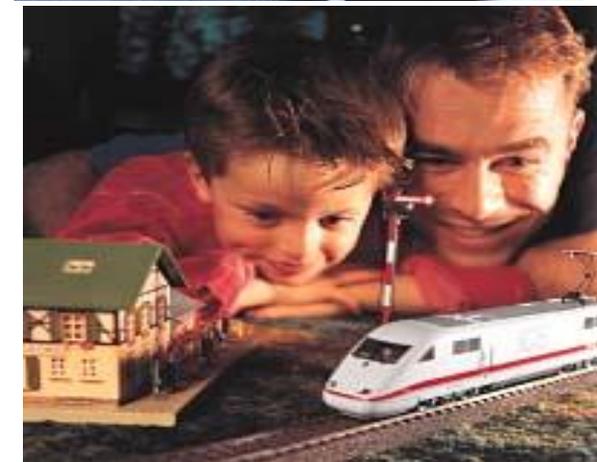
Offices



Home Applications



Electro & Electronics



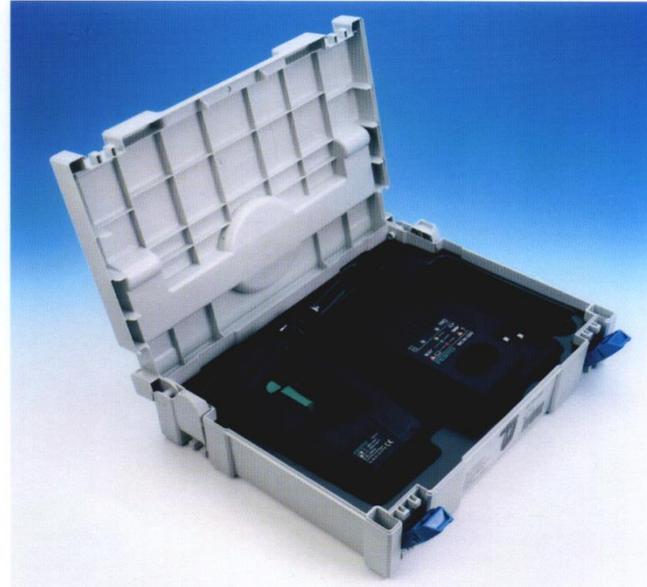
Toys

# Acrylonitrile Butadiene Styrene ABS

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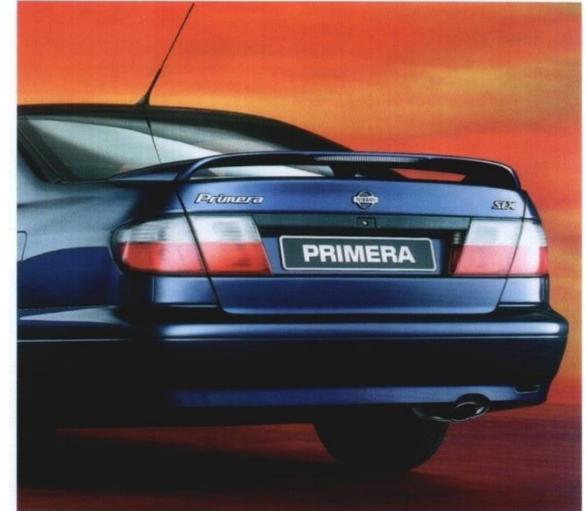


Phone Handsets



Briefcases

Rearview mirrors



Rear Spoilers  
(Blow Molded)

# Cosmetics



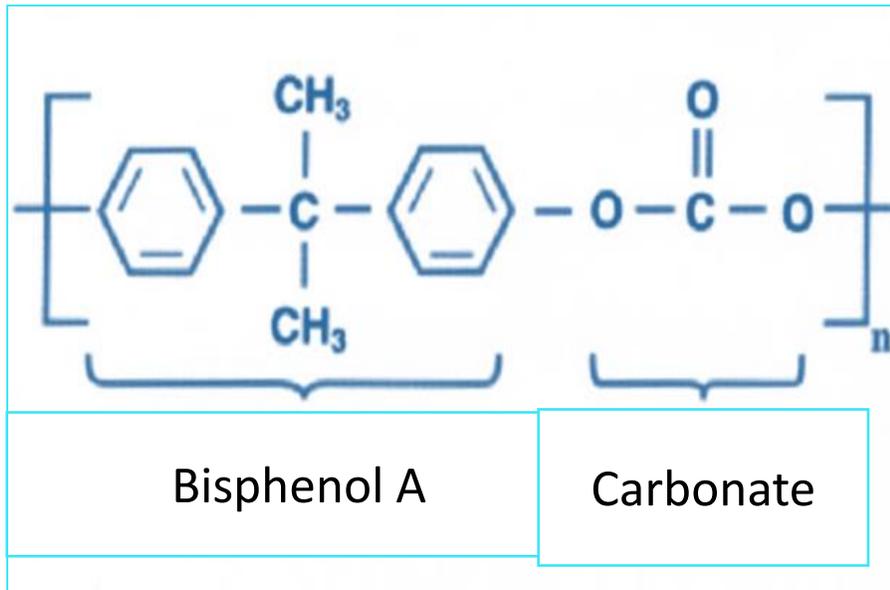


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# Leisure and Sports

# Poly (carbonate) PC



Poly (carbonate) is a polyester (2)

## Properties and applications:

High impact resistance (230 times greater than glass and 40 times acrylic)

Transparency close to that of glass

High thermal deflection temperature (HDT)

Promotional panels, water bottles, ...

Vehicle headlights, protective shields, safety glasses, ....

Penthouses, domes, ....

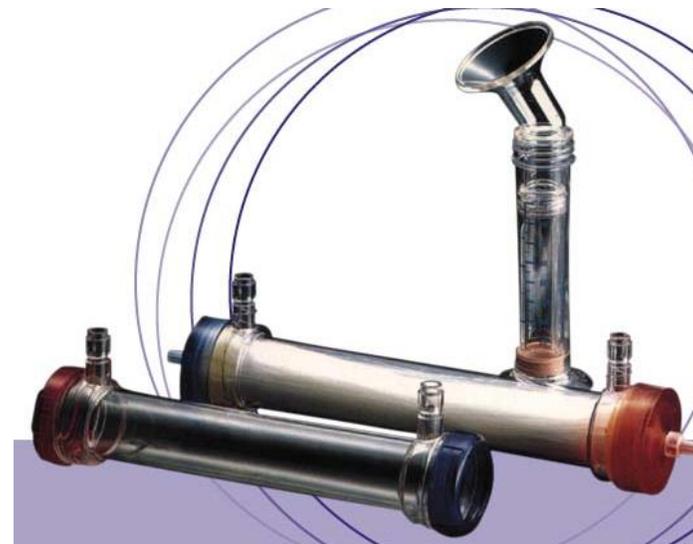
# Poly (carbonate) PC

- In recent years, industries have developed more benign synthesis processes from an environmental point of view, without poisonous phosgene and chlorinated solvents, using carbon monoxide or carbon dioxide as alternatives to phosgene, from the point of view of green chemistry and protection against the greenhouse effect. (1)
- In contrast to aromatic PCs, aliphatic PCs have received less attention from the industry because of their moderate properties. However, in recent years, some aliphatic PCs derived from carbon dioxide and biomass-based materials have been highlighted because of promising new alternatives to current fossil-based plastics.

## References:

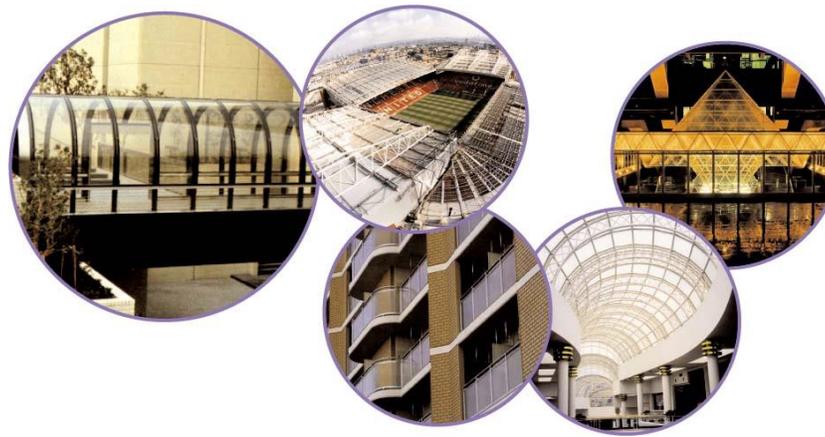
1. Ring Opening Polymerization and Special Polymerization Processes G. Rokicki, PG Parzuchowski, in Polymer Science: A Comprehensive Reference, 2012
2. Engineering Plastics - Technology and Applications, Helio Weibeck and Julio Harada, 2012.

# POLYCARBONATE Applications

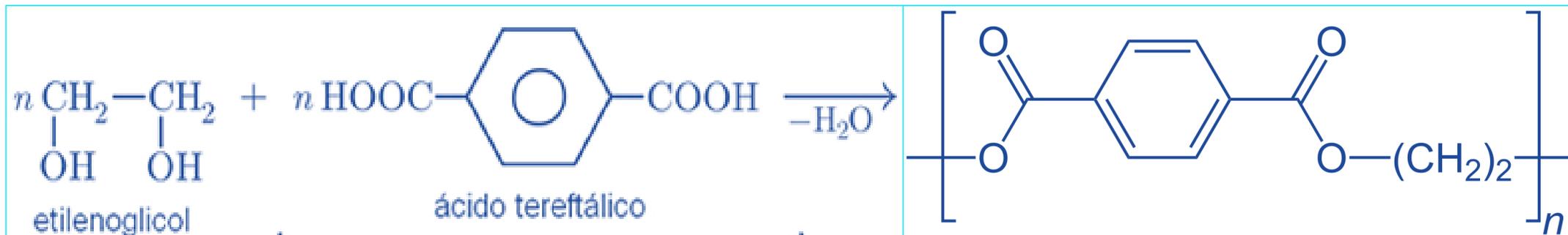


# POLYCARBONATE Applications

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# Poly (ethylene terephthalate) PET



## Properties

“High transparency”, excellent physical, mechanical and chemical resistance;

Possibility of recycling and incineration, not harmful to the environment

It works with molding temperatures up to 30% lower than PVC;

Low gas permeability.

# Applications



- Automatic Beverage Dispenser
  - Light transmittance
  - UV-resistant
  - Resistant to impacts and vandalism
- Bottles
  - Mechanical resistance
  - Chemical resistance
  - Good barrier to oxygen, carbon dioxide.
- Recyclability



# Polyethylene Terephthalate - PET

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# Polyethylene Terephthalate - PET

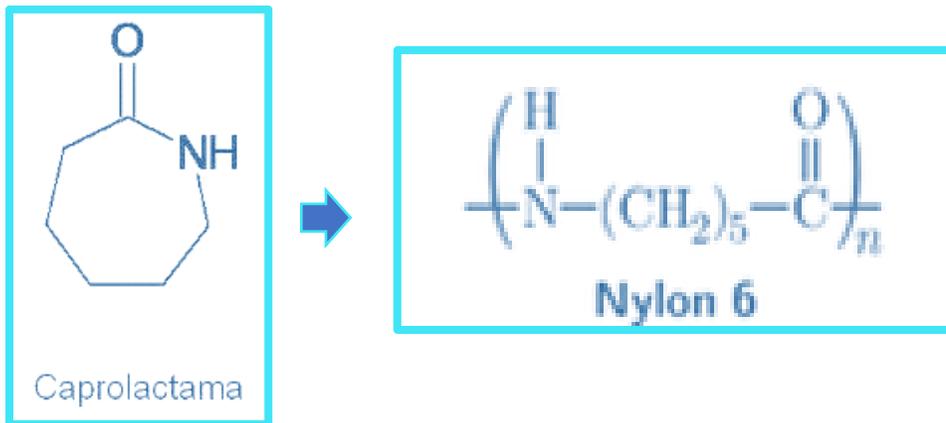


PET thermoformed packaging



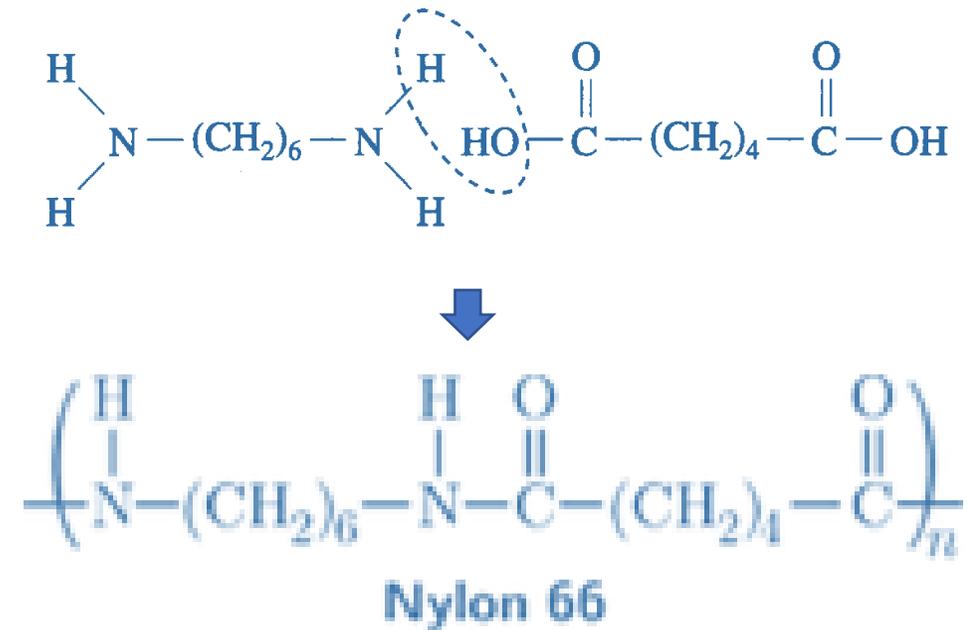
# Aliphatic polyamides, PA 6, PA 6.6

## PA 6



Thermoplastic, yellowish and translucent.

## PA 6.6



Thermoplastic, yellowish and translucent.

# Applications

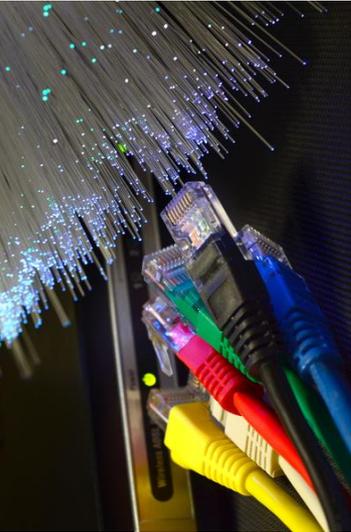
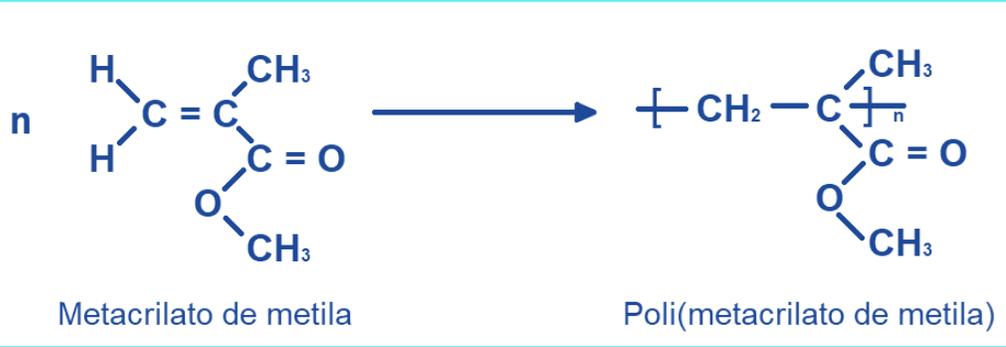


PA 66



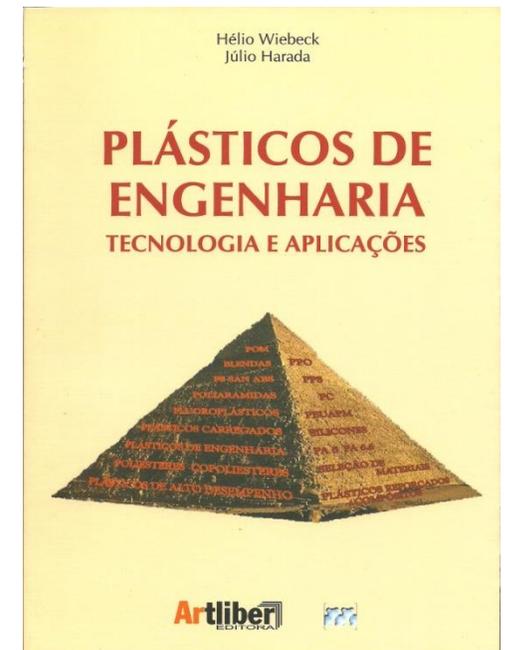
# POLYMETH META ACRYLATE - PMMA

Applications: optical fiber, optical lenses, optical disc substrates, ornaments, works of art and furniture, vehicle tail lights, whirlpool baths.



# Published books

## Julio Harada and ...



# Our best moment!

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**FOUNDERS****MANOEL LISBOA****MATERIALS ENGINEER**

Entrepreneur in the technology sector, graduated in materials engineering at the Federal University of São Carlos, MBA in Marketing from FEA-USP, an MBA in Business Management from UNESC-SC and a master's degree from the University of Waterloo - Canada. Specialized in Innovation and New Business.

**JULIO HARADA****PhD in Nano Technology and Advanced Materials**

Professor, PhD at UFABC, mechanical engineer at UNESP, specializing in industrial administration at USP and plastics in Japan and extensive experience in the plastics production and transformation industry. Author of several books and active in industry associations.

**CLAUDIO AP. MARCONDES****MATERIALS ENGINEER**

Materials Engineer from UFSCAR, Master's degree in Chemical Engineering from Unicamp, Post-graduate degree in Financial Administration from FAAP, Marketing Administration from ESPM and Strategic Management of Technological Innovation from Unicamp. He has been operating in the plastic market for 30 years.

# Thank You!

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