

# Difference Between Polypropylene and Polycarbonate

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## Key Difference – Polypropylene vs Polycarbonate

Polypropylene and polycarbonate are two widely used [thermoplastic elastomers](#) or plastic materials owing to their unique combination of properties. The key difference between polypropylene and polycarbonate is that **polypropylene consists of [aliphatic hydrocarbon chains](#)**, while **polycarbonate consists of [aromatic hydrocarbon chains](#)**. This difference has led these [polymers](#) to gain a completely different set of physical and mechanical properties.

## What is Polypropylene (PP)?

Polypropylene is an organic polymer made from propylene through a catalytic reaction. It was first produced by G. Natta in 1954 while considering the previous work done by K. Ziegler. Methyl groups are attached to every second carbon of polymer chain of polypropylene.

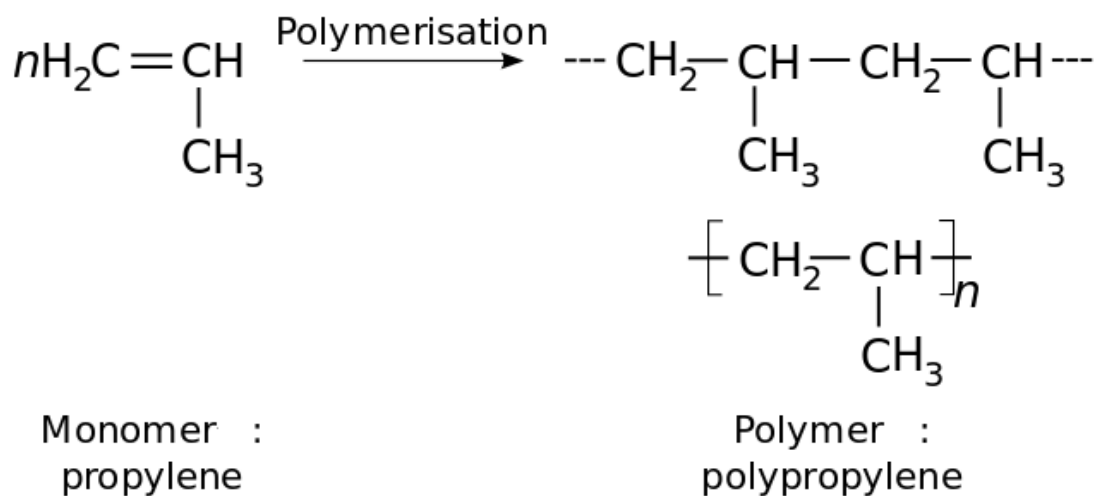


Figure 01: Polymerization of propylene

Polypropylene is a well-known thermoplastic elastomer that has good temperature resistant properties. Polypropylene is used for manufacturing trays, funnels, bottles, carboys, pails and instrument jars that need to be sterilized frequently in order to be used in the clinical environment. In addition, it has excellent mechanical properties such as good fatigue resistance, good chemical and environmental stress cracking resistance, good detergent resistance, high hardness, ease of processing by injection moulding and extrusion. Polypropylene is a high-volume commodity elastomer. When comparing the foams of [polyethylene](#), [polyurethane](#), and [polystyrene](#), polypropylene foams provide acceptable properties at a low cost unlike other two. Such properties

include better load bearing ability, increased flexibility and impact strength (due to low glass transition temperature). Polypropylene film is among the top packaging materials in the world owing to its low density and low production cost. It is used extensively in food packaging industry (almost 90% of total PP film production) and as a packing material for cigarettes, textiles and stationery products. Reinforced and filled polypropylene is used for the manufacturing of furniture, automotive and electrical appliances parts.



**Figure 02: Items made by Polypropylene**

The major disadvantages of polypropylene include significantly higher mould shrinkage, lower impact strength, and higher thermal expansion, especially at sub-ambient temperatures, unlike other major thermoplastic elastomers like PVC and ABS. Other properties of PP include poor adhesive and solvent bonding, poor flammability, limited transparency, low wear resistance, and low resistance to gamma radiation. PP is not health hazardous, but it can release carcinogenic volatile organic compounds (VOCs) during high-temperature processing. It is also known for its very low biodegradability.

## **What is Polycarbonate?**

Polycarbonate is a widely used thermoplastic elastomer for many products owing to its unique combination of properties, which are not found in any other single material including metal, glass or any other plastic. Such properties include excellent impact strength, heat resistance, inherent flame retardance, ease of process, and clarity. Because of this combination of properties, polycarbonate is widely used in many industries including appliances, automotive, business equipment, electrical and electronic components, lighting, medical devices, computers, and transport equipment.

Polycarbonate consists of linear polyester of carbonic acid in which dihydric phenolic groups are connected through carbonate groups. Polycarbonates are formed from bisphenol A and phosgene through either aqueous emulsion or nonaqueous solution polymerization. The addition of small amounts of polyhydric phenols can enhance the melt strength, flame retardance, and other properties. Polycarbonate is incompatible with strong alkaline solutions and is soluble in chlorinated hydrocarbons. Moreover, it is insoluble in aliphatic hydrocarbons. Both general-purpose and specialty grades polycarbonates are present in the market.

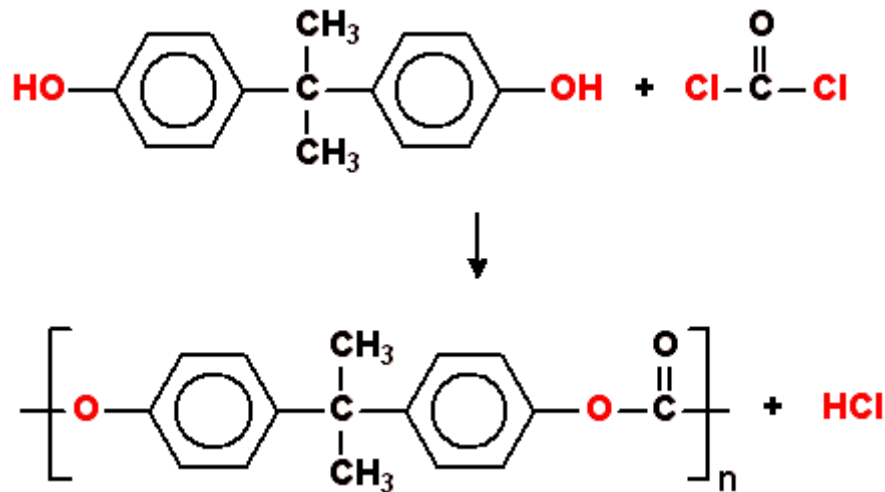


Figure 03: Synthesis of Polycarbonate

## What is the difference between Polypropylene and Polycarbonate?

Polypropylene vs Polycarbonate	
Polypropylene is an organic polymer made from propylene through a catalytic reaction.	Polycarbonate is a thermoplastic elastomer formed from the reaction between Bisphenol A and phosgene.
Nature of Hydrocarbon Polymer	
Methyl groups are attached to every second carbon of polymer chain; therefore, it is an aliphatic hydrocarbon.	Hydrocarbon is a linear polyester of carbonic acid in which dihydric phenolic groups are connected through carbonate groups; therefore, it is a polyaromatic hydrocarbon.
Manufacturing	
Polypropylene is manufactured from propylene with the use of Ziegler-Natta	Polycarbonate is manufactured using bisphenol A and phosgene through either

catalyst	aqueous emulsion or non-aqueous solution polymerization.
<b>Properties</b>	
Good temperature resistance, good fatigue resistance, good chemical and environmental stress cracking resistance, good detergent resistance, high hardness, ease of processing by injection moulding and extrusion are its properties.	Heat resistance, inherent flame retardance, ease of process, and clarity are properties of polycarbonate.
<b>Cost</b>	
Polypropylene is less expensive compared to polycarbonate.	Polycarbonate is more costly than polypropylene.
<b>Impact Strength</b>	
Impact strength is low.	Impact strength is high.
<b>Major Appliances</b>	
Polypropylene is widely used as a packaging material.	Polycarbonate is widely used to make electrical and electronic components and appliances.

## Summary – Polypropylene vs Polycarbonate

Polypropylene is a low-cost thermoplastic elastomer, which consists of aliphatic hydrocarbon chains and is mainly used in packaging industries owing to its high fatigue resistance, good chemical and environmental stress cracking resistance, low density, and ease of processing. Polycarbonate is among the most widely used plastics that consists of poly-aromatic hydrocarbon chains. Polycarbonate is mainly used in electrical and electronic, and automotive industry, owing to its high impact resistant, inherent flame retardance and ease of process. This is the difference between polypropylene and polycarbonate.

### References:

1. Tripathi, D. Practical guide to polypropylene. iSmithers Rapra Publishing, 2002. Print.
2. Margolis, J. Engineering plastics handbook. McGraw Hill Professional, 2005. Print.

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