Difference Between Perspex and Polycarbonate

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Key Difference – Perspex vs Polycarbonate

Engineering thermoplastic polymers such as polyethylene, polypropylene, polyvinyl chlorides, polycarbonate, polyacrylates are very popular in the current world due to their excellent combination of physical and chemical properties. However, none of these plastics shows complete perfectness. Perspex and polycarbonate are two such types of amorphous engineering thermoplastics that possess a different set of properties with their own advantages and disadvantages. The key difference between Perspex and polycarbonate is that **Perspex is produced by the polymerization of monomers of acrylic family, whereas polycarbonate is produced by the polycondensation polymerization of phosgene and BPA (bisphenol A) or melt transesterification of DPC and BPA**.

What is Perspex?

Perspex® is a commercial name of acrylic sheets, which were first discovered by ICI scientists in 1934. Perspex® is the registered trademark of Lucite International, which is operated under the Mitsubishi Chemical Corporation. Perspex® acrylic was the first acrylic products registered under synthetic resins in the form of sheets, rods, tubes, and other shaped pieces. The family of acrylate includes the polymers of the monomers of acrylonitrile, hydroxyethyl methacrylate, acrylamide, methyl cyanoacrylate, ethyl cyanoacrylate, methyl acrylate, ethyl acrylate, trimethylolpropane triacrylate, and methyl methacrylate. The polymerization of methyl methacrylate into polymethyl methacrylate (PMMA) was the first discovery of acrylate polymers in 1877 by the German chemists Fittig and Paul. After the commercialization of acrylic sheets, they were first used during the World War II for windshields, canopies, and gun turrets on airplanes and periscope ports on submarines.

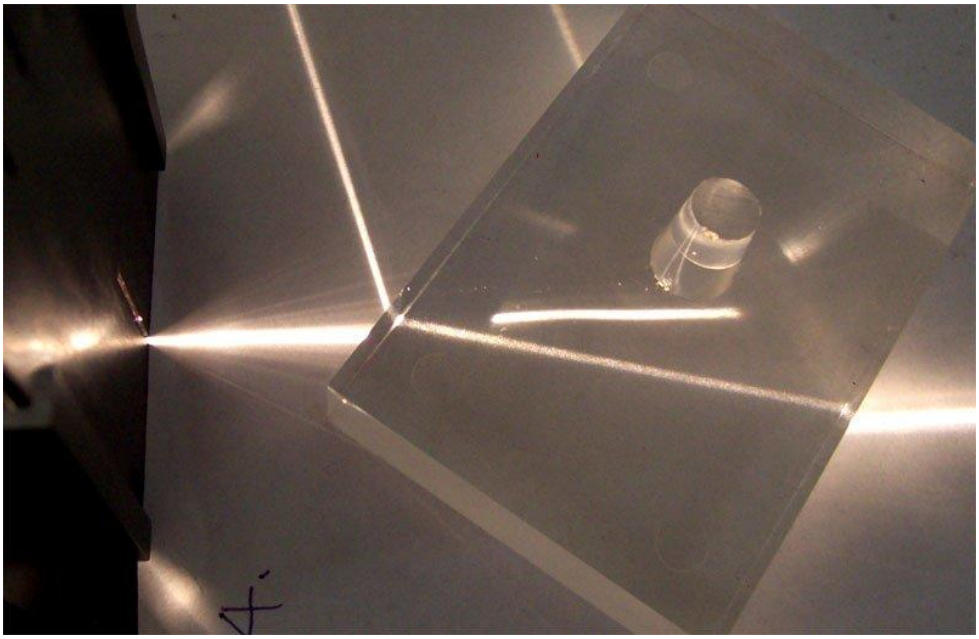

Figure 1: Refraction in a Perspex Block

Perspex® provides excellent optical clarity, chemical resistance, good abrasion resistance and excellent surface hardness that make the product suitable for a wide spectrum of applications including optical lenses, medical diagnostics, cosmetic packaging, and automotive rear lights. Perspex® polymers are ideal for extrusion and injection molding; it can be used to produce lighting products such as LEDs, extruded diffuser panels, profiles, and tubing. When compared to other commodity thermoplastics, acrylate polymers are costly due to their combinations of good physical and mechanical properties such as weather resistance, high strength, and brilliant clarity. PMMA has the glass transition temperature of 105- 107 °C, and the refractive index of 1.49, which is comparable to those of glass (1.60). Hence, PMMA is sometimes referred to as 'organic glass.' Owing to its high resistance to food, fats, oils, non-oxidizing acids, alkalis, salts, minerals, and aliphatic hydrocarbons, PMMA is widely used as a food-grade material and as a packaging material. However, it is not resistant to strong acids, aromatic and chlorinated hydrocarbons, ketones, alcohols, and esters. The dimension stability is good, but it has less impact resistance.

What is Polycarbonate?

Polycarbonate is a well-known transparent and amorphous engineering thermoplastic material that has a wide range of outstanding properties. It is a light-weight thermoplastic but has excellent toughness, dimensional stability, thermal resistance and optical clarity. Due to its high electrical resistance, polycarbonate is widely used to manufacture many electrical and electronic parts and components. Due to its optical clarity, polycarbonate is used to make eyeglass lenses and certain other digital media such as CDs and DVDs. Due to its wide spectrum of properties, polycarbonate is employed in a broad range of applications from usual household items to automotive and aerospace equipment and accessories. In addition, this thermoplastic material is

also used to make scratch-resistant glazing, medical and construction equipment, riot shields, safety helmets, and headlamp lenses. The history of polycarbonate goes back to the early 1890s as A. Einhorn first produced polycarbonate crystals by reacting resorcinol and phosgene in pyridine solvent. Later on, in the 1950s, commercial producers namely Bayer and GE were able to commercialize the processes for the manufacturing of polycarbonate resin based on bisphenol A (BPA).

Figure 2: Water Bottle made from Polycarbonate

At present, two methods are used to produce polycarbonate resins. The first method is the two-phase interfacial polycondensation polymerization of phosgene and BPA, and the second method is the melt transesterification of DPC and BPA at 300 °C and low pressure. The molecular weight of polycarbonate resins varies from 22,000 to 35,000 g/g mol. The glass transition temperature is between 145 – 150 °C. The presence of bulky aromatic aryl rings in the backbone of polycarbonate is the reason for its engineering properties. The melting point of polycarbonate is around 230 °C. It has good dimensional stability, creep resistance and high impact strength. Polycarbonate is considered as an inert material; therefore, it has been widely used as a food-grade plastic. The disadvantages of polycarbonate include low UV-resistance and hydrolysis by alkali solutions such as potassium hydroxide, sodium hydroxide, etc.

What is the Difference Between Perspex and Polycarbonate?

Perspex vs Polycarbonate	
Perspex is the registered trademark of Lucite International for acrylic sheets.	Polycarbonate is a common name (not a commercial name).
Manufacture	
Perspex is manufactured by polymerization of acrylic monomers or their copolymers.	Polycarbonate is manufactured by interfacial polycondensation polymerization of phosgene and BPA or melt transesterification of DPC and BPA at 300 °C and low pressure.
Clarity	
Clarity is very high, almost equal to glass.	Clarity is low compared to Perspex.
Glass Transition Temperature	
105- 107 °C	145 – 150 °C
Weather Resistance	
Weather resistance is very high.	This has a low UV resistance.
Applications	
Perspex is used in optical lenses, medical diagnostics, cosmetic packaging, automotive rear lights, windshields, etc.	Polycarbonate is used in scratch resistant glazing, medical and construction equipment, riot shields, safety helmets, etc.

Summary – Perspex vs Polycarbonate

Perspex is a trade name for acrylic sheets, which are manufactured by the polymerization of acrylic monomers and their copolymers. It has been widely used in medical industry, lenses manufacturing, automotive and packaging industry owing to its good chemical and weather resistance and excellent transparency. Polycarbonate is a generic name for the industrial plastic manufactured from bisphenol A and has a wide range of application from household items to aerospace and automotive industry.

Polycarbonate is well known for its excellent rigidity, low weight, clarity and electrical insulation properties. This is the difference between perspex and polycarbonate.

References:

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3. Ibeh, Christopher C. Thermoplastic materials: properties, manufacturing methods, and applications. CRC Press, 2011.

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