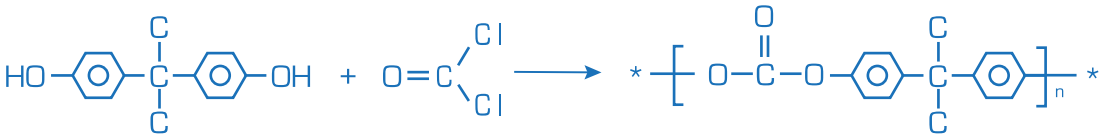
Steinwall
PLASTIC INJECTION MOLDING

Reliable Parts. Reliable People.

POLYCARBONATE

TECHNICAL ARTICLES | PLASTIC MATERIALS

Polycarbonate (PC) is an amorphous polymer with high impact strength, transparency, high temperature resistance and good dimensional stability[1]. PC is formed via stepgrowth polymerization of Bisphenol A (BPA) and carbonyl chloride.



Bisphenol A (BPA) Carbonyl Chloride PC (Polycarbonate)

PC is non-crystalline, yet is nearly as strong as highly crystalline polyamide (nylon) and polyacetal (Delrin®) plastics[2]. This mechanical performance is due to the large aromatic content in the backbone (the benzene rings) that gives high polymer stiffness. Observing the structure of PC reveals the moderately large pendant groups (the Oxygen and Carbon). These pendant groups promote entanglement with adjacent polymer chains. Also, the hydrogen and oxygen molecules will allow for hydrogen bonding to occur. All these factors increase resistance to intermolecular movement, which is needed for high strength. The resistance to intermolecular movement also gives PC good creep resistance[3].

PC does have some limitations: low abrasion resistance, susceptibility to stress cracking, low CO_2 permeability, decreased impact strength at lower temperatures and some UV (ultraviolet light) sensitivity. However, polymers blended with other resins can compensate for these limitations[4]. For example; PC reinforced with MoS_2, graphite or PTFE help improve slip and wear properties. The addition of short-strand glass fibers at 10-40% reduces stress cracking tendencies. Providing a boundary layer of a more crystalline polymer, such as PET (polyethylene terephthalate) or PBT (polybutylene terephthalate), reduces CO_2 permeability. A combination of PC+ABS (acrylonitrilebutadiene- styrene) will improve low temperature impact strength and decrease the notch sensitivity of PC. PC blends with PMMA (polymethylmethacrylate) increase UV resistance.

[1] Campo, E. Alfredo, *The Complete Part Design Handbook*, Hanser, 2006.
[2] Strong, A. Brent, *Plastics: Materials and Processing*, Prentice Hall, 2000.
[3] Brydson, J. A., *Plastics Materials*, Butterworths, 1989.
[4] Osswald, et al, *International Plastics Handbook*, Hanser, 2006.

www.steinwall.com

F (763) 767-7061
P (763) 767-7060 | (800) 226-9199
E sales@steinwall.com
A 1759 116th Ave. NW • Coon Rapids, MN 55448