

Polypropylene (PP) is a lightweight, rigid, and low cost material used in a wide variety of applications. PP is a commodity plastic easily produced in high volumes, which makes it a go-to material when starting the material selection process. Very frequently, PP is suggested as an alternative material when pursuing cost reduction opportunities on existing components.

The isotactic structure of polypropylene is the most widely used of the three types. Isotactic PP has a semi-crystalline structure that offers good mechanical properties such as stiffness and tensile strength<sup>1</sup>. When combined with different fillers such as talc, calcium and glass, the mechanical properties of PP can be dramatically enhanced. The addition of 30% short fiber glass reinforcement increases tensile strength and doubles the impact resistance<sup>2</sup>.

In general, PP is not very flame resistant. A non-halogen flame retardant, such as magnesium hydroxide, can be added to PP to produce a low smoke, flame retardant material. The mechanism involves the creation of metal oxides and water, which smothers the flame<sup>3</sup>. The downfall to placing flame retardant substances in PP is the reduction of UV resistance<sup>4</sup>. Carbon black can be added to PP to provide some protection against harmful UV rays.

Polypropylene is often compared to Polyethylene (PE) because it demonstrates many of the same characteristics as PP. There are some differences between these two plastics that will determine which plastic is better for an application. In general, PP has superior stiffness and stress cracking resistance compared to PE. Yet, PP is more sensitive to UV degradation than PE. The glass transition point and melting point are both higher in PP than in PE, which also creates higher service temperatures. For this reason sterilizable medical devices and dishwasher safe containers are made of PP<sup>2</sup>.

In the area of crack resistance due to mechanical stresses, PP out performs PE substantially. When subjected to extreme bending, PP does not blush or craze like PE will. This is the reason that PP is used in glue, carpets, ropes, strapping tape and items needing internal or living hinges<sup>2</sup>.

<sup>1</sup> Campo, E. Alfredo. The Complete Part Design Handbook, Hanser, 2006.

<sup>2</sup> Strong, A. Brent, Plastics: Materials and Processing, Prentice Hall, 2000.

<sup>3</sup> Maier, Clive, and Teresa Calafut. Polypropylene: The Definitive User's Guide and Databook. William Andrew, Inc., 1998.

<sup>4</sup> Karian, Harutun G. Handbook of Polypropylene and Polypropylene Composites. CRC Press, 2003.