SL 5.7

Compounding Flame Retardant Polypropylene

D. Chenouf, R. Glöckner, M. Moneke
Deutsches Kunststoff-Institut (DKI), D-64289 Darmstadt, Germany

To improve the fire retardant properties of plastics, they are compounded with different additives. The hydrated mineral fillers (MH and ATH) are environmentally more acceptable alternatives to halogen and some phosphorus-based compounds. To reveal effective fire retardant properties, a high filler level of hydrated mineral fillers is needed, typically more than 60 wt. %. This affects strongly the rheological and mechanical properties. The impact resistance and the elongation at break may decrease by a factor of hundred while the melt viscosity increases by a factor of 2:5.

In this study a polypropylene was compounded with aluminum hydroxide using two different compounding lines, a twin screw extruder (ZSK 30, Coperion Werner & Pfleiderer) and a co-kneader (MKS 30, Coperion Buss AG). Lubricant (wax) and coupling agents (maleic anhydride grafted polypropylene) were also used to improve the processing characteristics and the adhesion between the aluminum hydroxide and the polymer matrix respectively. By this the mechanical properties could be improved, too.
To evaluate the formulations, different flame retardant tests (Limiting Oxygen Index, UL94-V) were performed. The rheological (viscosity, Melt Flow Index) and mechanical properties (tensile, flexural and impact streng) of the compounds were determined, too.
The influence of the properties of filler and matrix material (size, MFI) on the compound properties was examined. The effects of the two processing machines and process parameters on the properties of the compounds were also investigated.

To minimize the content of additives without loss of the flame retardant properties, modified layered silicates (Nanofil, Suedchemie) were dispersed within PP/ATH compounds and their influence on the processing and compound properties was studied. An improvement of the flame retardant properties of the compounds was observed when adding 5 wt. % layered silicates only while at the same time the mechanical properties are suitable for cable compounds.

The present investigation demonstrates the possibility to use a polypropylene as matrix material for halogen free cable compounds. New possibilities for flame retardant polymers were investigated systematically.