

Editorial corner – a personal view

Is there any chance for polypropylene/clay nanocomposites in injection molding?

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The possibility of manufacturing nano-composites materials with tailored properties at low cost has gained much interest. In fact, there is already more than two decades of research on those materials. Particular interest has been paid to clay nanoplatelets and their composites with non-polar thermoplastic polyolefin matrixes, namely polypropylene (PP).

Imagine an industrialist and his design team relatively aware of the developments in the research with nano-fillers asking themselves: What can we do with nano-composites and make a net profit up to the 'promises' of the current state of the art? Research announced potential areas of interest for practical applications include mechanical performance, toughness improvement, surface hardening, fire retardancy, or, solvent and permeability reduction. However there remains the problem of how a company could set up the facility for compounding, and guarantee proper dispersion and minimization of health hazards. One should bear in mind that for industrial dissemination conventional equipments should be used and compounding achieved through in-line mixing of virgin resins and nanoclay masterbatches.

Since the seventies polypropylene has been seen as the wonder engineering-commodity material with widespread application in numerous technical applications. Current masterbatches are mainly based on thermoplastic polyolefins and anhydride functionalized PP as a compatibilizer. In principle, filling with a low incorporation level of nanoclay (typi-

cally less than 5%), makes PP adequate to applications with engineering requirements. Nevertheless, only well-dispersed and well-exfoliated nanoparticles can lead to the expected improvement of properties. The nanoparticle dispersion and exfoliation is usually assumed to be achieved during masterbatching, but the suppliers of masterbatches request a relatively high price. Tests at the industrial scale are reported with typical processing setup using PP mixed with nanoclay masterbatches. The results showed only minute improvements on stiffness. Conversely, the toughness was affected particularly in weld-line regions, and the surface tribological properties were not improved. Underlining these evidences poor exfoliation was a common feature in moldings obtained using industry achievable processing conditions.

There is an evident interest of bringing the benefits of nanocomposites at the laboratory scale to cost competitive industrial products. However the first available information leaves a number of treads that research could well follow, for example. Which level of exfoliation should be required to viable masterbatches? Is there any scope for hybrid compounding, i.e. combining particulate nanoclays with fibre reinforcements? Are there only a few niches of application for nanocomposites? Have nanofillers any chance of being full exfoliated within non polar matrixes? Do these nanocomposites will require alternative routes of processing? Should novel compatibilizers be developed in order to avoid unavoidable re-agglomeration during injection molding?

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