Editorial corner – a personal view

Water-mediated dispersion of ‘nanofillers’ in thermoplastics: Is it the right way?

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The extensive R&D work devoted to nanocomposites already resulted in new grades and products. Nevertheless, still great efforts are undertaken to improve the dispersion of ‘old’ and novel ‘nanofillers’ (layered silicates, carbon nanotubes /CNT/ and platelets). Though their interfacial modification is very helpful (and in some cases even a ‘must’) to achieve the desired dispersion, this is associated with some disadvantages. The type of the modification should be adjusted to the related polymer, which is usually rather costly. When pre-formed nanoparticles, like silica, TiO₂, CNT are incorporated, aspects of work health should be considered. This is necessary as the health hazards of long term exposure the human organism to such nanoparticles are not yet known. An elegant way to overcome the above problems is the dosage the nanoparticles in aqueous slurry, dispersion. CNTs can be exfoliated in aqueous media using suitable surfactants. Pristine clays are water swellable as their cations between the galleries become ‘hydrated’. Several nanofillers, like synthetic boemite aluminas, are water dispersible. When introducing the corresponding slurry in the polymer melt during extrusion, nanocomposites can be produced. By suitable dosage of the ‘nanofiller-source’ slurry, screw configuration with venting possibilities (to evaporate the water carrier) and selecting the right polymers (less prone to hygrothermal degradation), nanocomposites with improved property profile can be achieved in a cost-efficient way.

The fast evaporation of water (‘blow-up’ process) should support the fine dispersion of the fillers. There is a further promising option with this water-mediated technique. The toughness of the nanocomposites is usually lower than that of the matrix (note that this claim contradicts several reports, but likely this is the rule than the exception!). This is the reason why nanofillers are often used together with impact modifiers. It is noteworthy that the particle size of polymeric tougheners is in submicron range. But this is exactly the mean particle size of polymer latices, the dispersing medium of which is water. So, why not to produce nanomodified and toughened polymer systems at the same time, on-line in a suitable extruder?

The target morphology is a separate, fine and homogeneous dispersion of both latex and filler particles. There are many interesting possibilities when following this concept – however, you have to take care of the related patent literature. Good luck for your research!

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