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Editorial corner – a personal view
Compounding and processing of polymer nanocomposites: from scientific challenges to industrial stakes

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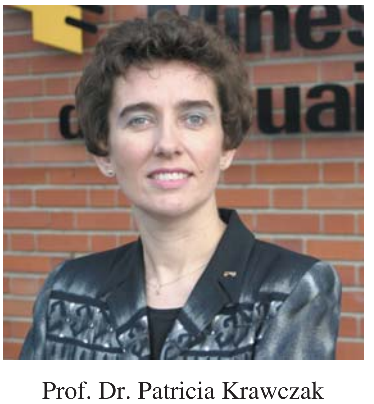
Polymer nanocomposites have emerged as new materials showing promising industrial application potential and have been the focus of an ever-growing interest in the past few years due to their quite exceptional properties at low filler contents (around 5 wt% or less). Compared to neat polymers and depending on the nanofiller used (nanofibres such as carbon nanotubes or cellulose whiskers, nanoplatelets such as layered silicate/clay or layered double hydroxides; nanosized isotropic particles such as silica or titanium dioxide), nanocomposites may offer:

- better mechanical properties (e.g. strength and modulus) and dimensional stability (reduced shrinkage and warpage)
- reduced permeability to gases and improved chemical resistance
- better thermal stability and heat deflection temperature
- flame retardancy and reduced smoke emissions.

However only well-dispersed and well-exfoliated nanoparticles can lead to the expected improvement of properties. Raw material producers, converters and end-users have therefore to tackle both compounding and processing issues. Surface modification of nanofillers with organic surfactant and adaptation of compounding conditions (high shear, high residence time, special screw profile design in case of melt compounding for example) may help to get rid of most of compounding issues. Research groups have made significant progress in that field. The development of masterbatches has reduced the health and safety hazards. The final injection- or extrusion-moulded part may be easily obtained by mixing/diluting the masterbatch with the appropriate polymer matrix. The nanoparticle dispersion (and exfoliation where applicable) is usually assumed to be achieved during the masterbatch compounding. Experience unfortunately often shows that the industrial reality is quite different. More research efforts are still required to identify the processing conditions that allow maintaining the dispersion and avoiding nanoparticle to aggregate again in the manufactured products.

In conclusion the high potential of nanocomposites has already been demonstrated at the lab scale. There is now time to bridge the gap between scientific challenges and industrial stakes. The key issue is currently to maintain nanoparticle dispersion during the industrial scale processing of nanocomposites on machines and equipments that are used to manufacture polymer composites parts on a regular basis. Efforts have to be oriented in this direction.



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