

Editorial corner – a personal view

Nanocomposite fibres: a strategy for stronger materials?

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The scientific literature is full of claims for the exceptional potentialities of nanoscale reinforcing materials, such as nanoparticles, nanofibres, nanotubes and nanoplatelets, to improve the mechanical properties of polymer matrices. However, most of the reliable data on the effective properties of polymer nanocomposites are somewhat disappointing, particularly when compared to structural composites reinforced with high-performance continuous fibers. The main reasons advocated to explain the discrepancies with theoretical predictions include poor dispersion, inadequate alignment of nanofillers, and bad stress-transfer ability at the interface (i.e. poor adhesion with polymer matrix). A possible route for introducing nanofillers into polymer matrices, and retaining a certain control on orientation and improving the dispersion level, can be offered by polymer fibres technology. In fact, the elevated draw ratios and elongational flow involved in typical fibre production processes can concurrently promote a disruption of the aggregates and a strong orientation of the nanofillers along the fibre axis. A variety of processing techniques can be adopted for the production of nanocomposite fibres, including spinning from polymer melts or solutions, gel-spinning, melt-blowing and electrospinning.

This approach has been proven to be extremely efficient when nanofillers with an elevated aspect ratio, such as nanofibres or nanotubes, are concerned. In fact, in the last decade several papers have been published documenting the extraordinary reinforcing efficiency of single- or multi-

walled carbon nanotubes in highly oriented polymer fibres or tapes.

More recently, some successful attempts have been made to extend this approach to nanoplatelets, in particular layered silicates and graphene.

Among the drawback to overcome, one can list the marked viscosity increments generally induced by nanofillers in polymer matrices, and the consequent necessity to identify proper processing conditions for the fibre production. Moreover, the decrease of elongation at break (which is also reflected in the molten state) typically induced by some nanofillers may also limit fibre preparation possibilities.

The outstanding properties of nanocomposite fibres could improve traditional textile products, or be exploited in some advanced processing technologies, such as single- or all-polymer composites and commingled yarns composites.



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