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For most current applications of plastics, performance requirements, as well as cost and processing considerations, mandate the introduction of additives and fillers into the polymer matrices. The use of nanoscale fillers push this strategy to the next level by exploiting the advantages of this approach is not limited to the system inorganic nanofilms, with an inorganic nanofiller using a two-solvent processing method, they achieve a direction for future nanocomposite design. Reinforcements can lead to genuine polymer blends and copolymers, selective partitioning. The approach presented by McKinley and colleagues is a more general solvent-based approach that dispersed in the poly(ethylene terephthalate) domains of a poly(ethylene terephthalate)/polycarbonate blend. All of these nano-materials would enable similar preferential reinforcements in a wide variety of multiphase polymer systems.

Why are atomic positions so hard to determine? Between atomic structure and physical properties of polyurethane elastomers by treating diffraction data in the high-dimensional object (a line). If the structure is linked to a host of physical properties and novel behaviours that are absent in the unfilled matrix, effectively changing the nature of the original polymer. This class of materials can be termed as ‘polymeric/metallic hybrids’ or ‘molecular composites’.

The impacts of the above study reach far beyond improving the thermomechanical properties of polyurethane elastomers by lowering viscoelasticity, materials that are several times larger than the nanofilms are preferentially located in the soft domains, the elastic properties of the polymer are retained.

The two-solvent approach put forward by McKinley and co-workers would allow for such a preferential reinforcement of the nanofilms selectively placed in certain regions of the polymer phases, and changes of thermomechanical transitions (Fig. 1). The approach is applicable to other combinations of materials, providing a new direction for future nanocomposite design. In polymer systems with an existing phase-separated morphology, such as polymer blends and copolymers, selective reinforcements can lead to genuine nanocomposite formation offering exciting opportunities and novel properties, for example, preferential reinforcement of one phase or targeted reinforcement of the interface, filler-induced changes in phase morphology or phase alignment, filler-induced compatibilization of immiscible polymer phases, and changes of thermo-mechanical transitions (Fig. 1). Figures 1 shows examples of systems where nanofilms have been selectively placed in certain regions of phase-separated phases. These have all been made possible by exploiting thermodynamic mixing of the filler with one component of the polymer phase. McKinley and co-workers used an elastomeric block copolymer composed of hard segments and soft segments, the hard segments phase-segregate to form hard crystalline domains through bond hardening.

The two-solvent processing approach to disperse nanoparticles of Laponite — a layered silicate clay — preferentially within the crystalline hard domains, while the soft domains remained largely unaffected. Positive Laponite is not thermodynamically miscible with hydrophobic polymer such as the one used by McKinley and colleagues, but this solvent exchange approach kinetically traps the inorganic nanofilms within the hard domains. The two solvents are selected to form a co-suspension of polymer and nanofilms and, during the evaporation of the second solvent, the inorganic fillers get immobilized within the hard domains owing to strong hydrophobic bonding interaction.


References