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**Multi-component Hybrid Composites Containing Inorganic Nano and Micro Fillers: Processing/Morphology/Property Relationships.**

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The incorporation of particulate or fibrous fillers into polymers or polymer blends can greatly influence the microstructure and therefore the final properties of the composites. Fillers consisting of nano-sized particles have a strong influence on polymer materials properties. The presented study deals with systems based on two immiscible polymers containing micron-sized and inorganic nano-sized fillers, added simultaneously to the blends during melt mixing. Polypropylene PP was used as the matrix and copolyamide PA as the minor phase. Titanium oxide TiO<sub>2</sub> nano-powders of 200nm and 20nm primary particle size were used as the nano-filler. Mica, or talc, or wollastonite were used as the micron-sized filler. It is shown that such materials are characterized by a segregated structure where fillers, micron-size and nano-size are attracted to the PA phase. The micron-size filler particles are enveloped by the PA phase and TiO<sub>2</sub> particles are mainly located upon the PA phase surface and partly within it. The morphology of the composites was characterized as well as mechanical and thermal properties. The sequence of ingredient incorporation into the melting equipment has a significant influence on the morphology of the composite. When both fillers are premixed with PP and PA was subsequently added, the composites are characterized by a finer structure, with finer micron-size filler dispersion and a very fine dispersion of the nano-particles upon the PA particles surface. No agglomerates of the nano-sized fillers are seen in the two step melt mixing composites. Mechanical properties of the studied materials are significantly influenced by the addition of the two fillers. Some of the studied composites demonstrate unusual enhancement of elongation at break and Izod impact energy.

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