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INVESTIGATION OF THE PROCESSING, THE MORPHOLOGY AND THE MECHANICAL PROPERTIES OF MICRO/NANO-COMPOUNDS

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The increasing demand of lightweight parts with excellent mechanical properties pushes polymers into applications which are so far dominated by metals or ceramics. Adequate fillers are added to the polymer matrix to improve the properties. Standard fillers to enhance mechanical properties are glass and carbon fibers as well as mineral fillers. Regarding the mechanical properties, the potential of fillers on micrometer scale is limited because high filler contents are necessary. By now, fillers on nanometer scale have been investigated for over 20 years. Due to the high specific surface area, fillers on nanometer scale have a high potential to improve mechanical properties even at low filler contents. Processing compounds containing nanofillers on industrial scale shows only limited improvement of the mechanical properties. Nanofillers tend to agglomerate during processing and thus a loss of the positive properties of nanofiller is seen. For a combination of fillers on micro- and nanometer scale, synergetic effects can be observed. For this reason, a compound consisting of micro- and nanofiller possesses a high potential to improve mechanical properties. In this paper, the processing, the morphology and the mechanical properties of a compound consisting of the matrix polymer polypropylene, the microfiller glass fibers and the nanofiller layered silicate are examined to investigate synergetic effects of a micro/nano-compound. The micro/nano-compound is processed using a 26 mm co-rotating intermeshing twin-screw extruder. Test specimens are further processed by injection molding. The morphology and the mechanical properties of the injection molded parts are examined to further develop the new compound and the process to produce micro/nano-compounds.