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Structure and Properties of Multilayered Polymer Composites

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The design of nanostructured materials with specific mechanical and functional properties is one of the important aspect of contemporary polymer science and engineering. In this regard, the polymers consisting of nanolayers have attracted a great research interest due to their promising mechanical, optical and barrier properties. Recent studies have demonstrated that a significant variation in mechanical behavior of polymers results on changing the sample dimension from macroscopic down to micro- and nanoscale. In this work, we investigate the structure formation and deformation behaviour in multilayered polymer composites based on polycarbonate (PC) and polyethylne terephthalate (PET) and compare their morphology and deformation mechanisms with those of corresponding blends. The main techniques used are electron microscopy and atomic force microscopy. It was found that the deformation mechanisms of these composites are dictated by thickness of the individual polymer layers. Unlike the formation of 'homogeneous' plastic zones in the starting materials (i.e., PC and PET), the composites comprising alternating layers deformed via initiation of local shear bands in individual layers (one-component behaviour) up to a layer thickness of about 1 micron. Below 1 micron layer thickness, the shear bands were found to extend to several adjacent layers (one-component behaviour).