

## **Nanocomposites and nanomaterials**

### **Effect of simple shear induced orientation process on the morphology and properties of polyolefin/graphite nanoplates composites**

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Recent substantial practical interest is attracted by possible reinforcement of polymers by nano-scale materials. Graphite nanoscale platelets (GnPs) or graphite nanosheets are the most popular nanoreinforcements. Due to a high characteristic ratio (above 1000), high strength and rigidity, and low density of GnPs, their incorporation into a polymeric matrix allows sufficient improvement of the physical and chemical properties of the produced polymeric composites accompanied by a low volume content of the nanoreinforcement. It is also known that the enhanced mechanical properties of polymer nanocomposites can be attributed to the strong molecular/crystal orientation.

In this work the advantages of the reinforcement effect induced by solid state simple shear was demonstrated on the example of polyolefin/GnP composites. As an simple shear induced orientation method, equal-channel multiple-angular extrusion was selected. It was shown that the simple shear promotes significant changes in the crystal structure and the morphology of the GnP and the polymer matrix: extensive destruction of the GnP agglomerates accompanied by exfoliation into the layers consisting of several graphite plates, GnP crystal and crystal lamellae orientation. The oriented nanocomposites were characterized by a reduced porosity and improved adhesion between the GnP and the polymer matrix. An increase in rigidity, strength and plasticity was observed, being accompanied by a substantial decrease in the thermal expansion coefficient of the GnPs-based nanocomposites. The effects depended on the type of the polymer, concentration and morphological characteristics of GnP.