

# Different commercial graphene nanoplatelet materials melt mixed in polymer composites

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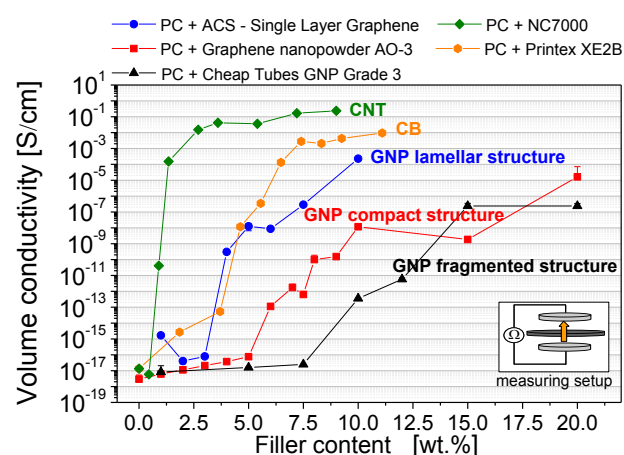
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In order to improve especially the electrical and thermal conductivity of polymers, quite often graphitic materials are used and incorporated by melt mixing. Among them, structures with nanosized thicknesses are developed in the recent years, by their producers quiet often named as "Graphene Nanoplatelets (GNPs)", even if acc. to [1] they have to be assigned to the group of graphite nanoplates. The influence of the morphology of such industrial GNP materials on their dispersion in polycarbonate (PC) is studied. Three GNP morphology types were identified namely lamellar, fragmented or compact structure. The dispersion evolution of all GNP types in PC is similar with varying melt temperature, screw speed, or mixing time during melt mixing. Increased shear stress reduces the size of GNP primary structures, whereby the GNP aspect ratio decreases. A significant GNP exfoliation to an individual layer or few graphene layers could not be achieved under the selected melt mixing conditions. The resulting GNP macrodispersion depends on the individual GNP morphology, particle sizes and bulk density and is clearly reflected in the composite's electrical, thermal, mechanical, and gas barrier properties. Based on a comparison with carbon nanotubes (CNT) and carbon black (CB), CNT are recommended in regard to electrical conductivity, whereas, for thermal conductive or gas barrier application, GNP is preferred.

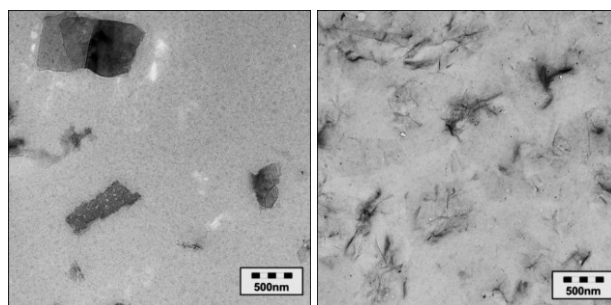
## References

- [1] A. Bianco, H.-M. Cheng, T. Enoki, Y. Gogotsi, T.H. Hurt, N. Koratkar, T. Kyotani, M. Monthieux, C.R. Park, J.M.D Tascon et al. Carbon 65 (2013) 1
- [2] Michael Thomas Müller, Konrad Hilarius, Marco Liebscher, Dirk Lellinger, Ingo Alig, and Petra Pötschke, Effect of Graphite Nanoplate Morphology on the Dispersion and Physical Properties of Polycarbonate Based Composites, Materials 10 (2017) 545

## Figures



**Figure 1:** Electrical percolation behavior of various commercially available carbon fillers in polycarbonate [2]



**Figure 2:** Comparison of the shapes of GNPs with a compact (left) and lamellar structure after embedding in polycarbonate (TEM images) [2]