

Dispersion and crystallization of polypropylene/expanded graphite microcomposites: effect of graphite size

Quentin Beuguel, Daniel Settipani, Jean-Marc Haudin, Bruno Vergnes,

Severine A.E. Boyer, [Edith Peuvrel-Disdier](mailto:edith.disdier@mines-paristech.fr)

MINES ParisTech, PSL - Research University, CEMEF - Centre de Mise en Forme des Matériaux,
UMR CNRS 7635, CS 10207, 06904 Sophia-Antipolis, France
Email address of speaker: edith.disdier@mines-paristech.fr

Polymer crystallization can be considered at different levels: nucleation, growth and overall kinetics. Because these levels are, in turn, materials dependent, the present work intends to evaluate how size and volume fraction of expanded graphite particles can affect the three crystallization levels in an isotactic polypropylene in quiescent and isothermal conditions.

Neat polypropylene (PP) was Moplen HP400R (LyondellBasell). The selected expanded graphite particles were KNG-180, KNG-150 [1] and KNG-G5 [2] (Knano®). Composites with three volume fractions of graphite varying from 0.3 to 2 % were prepared in the same conditions in an internal mixer. The dispersion state of the particles in the composites was characterized at different scales using SEM and TEM. Crystallization was studied by optical microscopy, DSC and X-ray diffraction.

Expanded graphite particles were found to have a flake shape with a micrometric size. At a given volume fraction, graphite particles enhanced the kinetics of crystallization of PP especially in the presence of KNG-150, KNG-G5 and KNG-180, acting as nucleating agents [3]. The crystal nucleation of PP was found to be located on the surface of the micrometric graphite particles giving rise to transcrystalline growths in the microcomposites [4]; but related to the difference in stacking dimension of graphite particles. Radial growths were also observed. Crystalline planes of PP (040) and of graphite (002) were found to be oriented parallelly.

References:

- [1] G. Chen, C. Wu, W. Weng, D. Wu, W. Yan, *Polymer* 44 (2003) 1781
- [2] W. Zhao, F. Wu, H. Wu, G. Chen, *Journal of Nanomaterials* (2010) 528235
- [3] S. Zhao, F. Chen, Y. Huang, J-Y. Dong, C.C. Han, *Polymer* 55 (2014) 4125
- [4] M.C. Branciforti, C.A. Oliveira, J.A. De Sousa, *Polymer Advanced Technologies* 21 (2010) 322

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