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PREPARATION AND PHOTOTHERMAL CHARACTERIZATION OF NANOCOMPOSITES BASED ON HIGH DENSITY POLYETHYLENE FILLED WITH EXPANDED GRAPHITE: PARTICLE SIZE AND SHAPE EFFECTS

Mihai Chirtoc [(1)], Nicolas Horny [(1)], Ismail Tavman [(2)], Alpaslan Turgut [(2)], Iskender Kökey [(2)] and Mária Omastová [(3)]

[(1)] Université de Reims Champagne Ardenne URCA, GRESPI, Multiscale Thermophysics Lab., Moulin de la Housse BP 1039, Reims, 51687 France

[(2)] Dokuz Eylul University, Mechanical Engineering Department Bornova, Izmir, 35100 Turkey

[(3)] Polymer Institute, SAS, Dúbravská cesta 9, Bratislava, 845 41 Slovakia

SUMMARY: This work aimed at thermal transport characterization of high density polyethylene (HDPE) filled with two sizes (5 and 50 μm) of expanded graphite (EG) particles. Sample platelets were produced by melt mixing followed by compression molding. Thermal conductivity *k* was determined by combining measurements of density, specific heat capacity and thermal diffusivity. For the latter, we used the self-checking, non-contact method of photothermal radiometry (PTR) in back detection configuration. Starting from an effective medium approximation model, we derived a simple linearized expression for the effective *k* of composites with low particle charge. It explains the unusually high experimental *k* values (up to four-fold increase) as the effect the strongly non-spherical EG particles (aspect ratio $1/p$=110 - 290). Larger particle sizes produce higher *k* enhancement, while the interfacial thermal resistance (R_{bd} = $2.1 \cdot 10^{-7}$ $m^2 \cdot K/W$) has an opposite effect on *k*. The eventual deviation of experimental *k* from the model at high particle charge is possibly due to limitation of interparticle free space preventing random orientation of high aspect ratio particles.