Thermal Characterization by Front Flash Laser of Composites Loaded with Graphite Rod Inclusions and the Influence of Their Distribution on the Thermal Properties

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One of the most important challenges in composite materials is to determine how their thermal and mechanical properties are affected by the distribution of the inclusions. In this work, well-oriented (longitudinally) graphite rods with high thermal conductivity are used as inclusions in a cylindrical polymeric matrix. The thermal properties of the composites were measured using a noninvasive photothermal thermography. The samples studied have 30, 40, 50, and 60 graphite rods corresponding to concentrations of 5.39, 7.18, 8.98, and 10.78 % v/v of graphite, respectively. In addition, the rods inside the matrix were distributed in three different geometrical configurations: polygonal, rectangular, and radial. The imaging of the heating on the surface of the sample is monitored for the different configurations allowing us to define well-limited sections with spatially distributed effective thermal properties related with the arrangement and concentration of the rods. The well limited sections have shown how a composite material with this kind of inclusion presents heterogeneity according to the distribution and number of rods in it. Showing that building a material with specific thermal characteristics per region is possible. In addition, these measurements are compared with polymer composites with the same v/v concentration of powdered graphite randomly distributed inside the matrix. Our work is important in systems in which an ad-hoc predetermined distributed heating of a surface is required.

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