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High-performance microwave-absorbing and thermal conductivity epoxy matrix composite reinforced with industrial mill scale waste

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Composite materials based on polymer matrix have been produced using the casting technique and blending epoxy resin with mill scale (MS) in different ratio. The results show that these composites are good absorbent of microwave electromagnetic radiation. The experimental was also intended toward investigation of the thermal conductivity of powder-filled using Lee's disc method. Various contents of MS (8–40 wt.%) were added to the epoxy to improve or modify their properties. The as-prepared composites were characterized by X-ray diffraction. In addition, after FT-IR investigation it was possible to observe a strong and sharpen band with O-H vibration. These results are important when investigating the structure and composition of composites. The MS particles, of 63 μm in size, were determined by scanning electron microscopy (SEM) and energy- dispersion X-ray optionally spectroscopy. The thermal conductivity of the composites was measured at room temperature using the Lee's disk method. The 38 °C glass transition temperature (Tg), melting time 39 (Tm) were obtained from the differential scanning 40 calorimeter (DSC). It was found that MS concentration had a significant impact not only on the absorption of microwave radiation but also thermal conductivity (K). The maximum RL was -30.74 dB at 11.51 GHz for 24 wt%, and also in the case of a filler concentration of 40 wt%. The maximum K measured for the 8 wt% MS formulation was 0.072 W/m·K.

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