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Enhanced (X-band) microwave shielding properties of pure magnesium by addition of diamagnetic titanium micro-particulates

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Abstract

Magnesium based micro-composites are known to have good mechanical integrity and are broadly investigated for different structural applications, however, their electromagnetic interference (EMI) protecting viability has rarely been studied. Thus, with an increasing interest in developing components made of magnesium alloys/composites for EMI SE (shielding effectiveness) applications, this study focusses on the electromagnetic shielding, electrical and magnetic properties of Mg/xTi (x = 5, 10, 15 wt. %) micro-composites in correlation to the microstructure. The results indicated that there was grain refinement with progressive addition of Ti particulates in the Mg matrix. It was also found that the electrical conductivity of the composites decreased with increasing Ti amount. The magnetic characterisation performed on the samples verified that the composites are non-magnetic in nature. An interesting observation was made in this study pertaining to the SE values of the micro-composites. The SE values in the X-band microwave range (8.2-12.4 GHz) showed that with an increase in Ti wt%, the SE value remained equal among all the magnesium titanium composites, but improved in comparison to pure magnesium. This was attributed to decreased reflection (SE_R) (due to decrease in volume of Mg matrix with increase in amount of Ti reinforcements) and simultaneously increased absorption (SE_A) (due to increase in amount of Ti which led to multiple internal reflection) coefficients of the shielding effectiveness.

Keywords: Magnesium micro-composites, Electromagnetic Interference, Shielding Effectiveness, Ti micro particulates, Multiple reflection, microstructure.