Self-heal able thermoplastic polyurethane composites containing ferrite decorated graphene sheets for efficient microwave shielding

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Abstract

Self-healing polymers are in great demand in almost every coating application. With an increase in electromagnetic (EM) pollution, curbing the same has become an urgent necessity [1]. Light weight coatings and conducting polymeric materials are being highly researched upon in this regard and combining these properties with self-healing systems would open new avenues in EMI shielding (specifically in the microwave frequency domain) applications [3-4]. In the current study, a novel approach towards development of microwave shielding materials capable of self-healing through microwave heating has been attempted. A covalently crosslinked material was developed using Diels-Alder (DA) chemistry which shows self-healing properties when stimulated by heating. Herein, reduced graphene oxide grafted with magnetite nanoparticles (rGO/ Fe_3O_4) was covalently crosslinked to thermoplastic polyurethane (PU) using DA chemistry. The addition of multiwalled carbon nanotubes (MWNTs) into these nanocomposites led to exceptional EM wave shielding and self-healing properties through a synergistic effect. The synergism led to exceptional EMI shielding of -36 dB, primarily through absorption in the microwave region of the electromagnetic spectrum. When used in the form of thin coatings of about 1 mm in thickness, the shielding value reached -28 dB, manifesting in more than 99 % attenuation of EM waves through absorption [4].

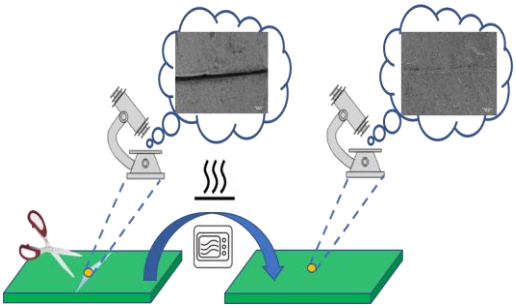

Figure 1: Self-healing of cuts on PU coatings

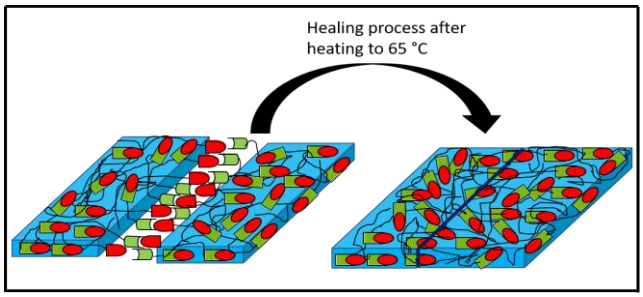

Figure 2: Mechanism of Diels alder self-healing process

References

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