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The surface functionalization of materials originated from e-waste for their application in thermosetting polymers

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Non-metallic fraction (NMF) remained as a fine powder after mechanical processing of printed circuit boards, was modified by chemical (oxidation) treatment in order to improve the efficacy of physical recycling. The oxidation procedure was performed using chemical agents are: hydrogen peroxide (H₂O₂), the mixture of hydrogen peroxide and sulfuric acid (H₂O₂/H₂SO₄) v/v 2:1, and ethylene diamine (C₂H₈N₂). Further on, modified materials (NMF1, NMF2 and NMF3, respectively to the order of chemical treatments) were used as a filler/reinforcement in unsaturated polyester resin (UPR) matrix, which was synthesized from poly (ethylene terephthalate) (PET) waste. The effect of oxidation process was investigated varying the amount of NMF (NMF (1-3)) particles in the range of 0.1-2.0 wt%, as well as mechanical properties of pure UPR and composites with corresponding fillers. The best enhancement of tensile strength was achieved with filler amount up to 1.0 wt%, while micro Vickers hardness was significantly improved for each NMF loading. The addition of the NMF1 showed the highest improvement of mechanical characteristics, while the composites filled with NMF2 manifested decrease of tensile strength and micro Vickers hardness, compared to the properties of pure UPR. In this study, the use of commercial/industrial wastes (PET and NMF) were evaluated and valorized through their synergy in new/eco/multi-functional materials for potential application in industry, mining and construction.

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