

Abstract

Composites Based on Waste Printed Circuit Boards (WPCB) and Waste Polypropylene †

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The high amount of plastics, which are durable, lightweight, and cheap materials, is one of the major current ecological concerns. The recycling of waste printed circuit boards (WPCB) has been an increasingly debated issue in the last two decades at government level and worldwide as they have a particularly harmful polluting effect (e.g., heavy metals and brominated compounds used as fire retardants) due to their non-biodegradability. WPCB recycling by blending with polypropylene waste (RPP) can be considered as a potential method with both technical and ecological implications. The research aimed to obtain impact-strength RPP composites using block-copolymers as impact modifiers and WPCB as the reinforcing agent. After the collection, the WPCB were ground into powder less than 1 mm size. The metallic parts (Cu) were removed by leaching and solvent evaporation. The waste polypropylene was collected from industrial injected boxes (density 0.96–0.99 g/cm³; melt flow index at 190 °C and 5 kg of 6 g/10 min, tensile strength 2.06 MPa, elongation at break 2.83%, and IZOD impact strength at 23 °C of 6 kJ/m²). As impact modifiers, a styrene-butadiene block-copolymer (SBS, Europrene 161 C) and a maleinized and hydrogenated block-polymer (SEBS-MA, Kraton FG 1901X) were used. The composites were obtained through melt compounding and the tensile and impact properties of the composites were determined. The composition influence on mechanical and impact properties of the RPP–elastomers–WPCB composites highlighted that impact strength improvement is controlled by elastomer domain size, their dispersion degree into the polyolefin matrix, and the compatibility between components. WPCB act as a reinforcing agent of the RPP matrix. Obtaining composites based on polyolefin waste and WPCB can be considered as a potential method for removing unused plastics from the environment. The new materials produced can be used for: different technical benchmarks for the construction industry, hangers, transport shuttles, and industrial containers, amongst other uses.

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