

Novel Segregated Network Electrically Conductive Polymeric Nanocomposites using Metal Nanowires

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Composites have unique multifunctional properties resulting from the size and shape of the fillers. Polymer nanocomposites display superior electrical, thermal and mechanical properties to conventional polymer composites due to the nanoscale size of the filler. In this work, Copper and Silver nanowires were synthesized using an aluminum oxide template based electro-deposition technique, and the nanowires were melt-mixed with Polystyrene (PS), amorphous nylon (PA) or polycarbonate (PC) in miniature mixers, and electrical and mechanical properties were tested. Nanocomposites were made in different miniature mixers including two in-house developed miniature mixers, the "Alberta polymer asymmetric minimixer" (APAM, volume 2ml) and the "Mini-batch mixer"(MBM, 3ml - a scaled down version of a typical laboratory mixer), as well as in a DSM mini-twin-screw-extruder (5-15ml). The morphology of the polymer nanocomposites was characterized by transmission electron microscopy (TEM) and scanning electron microscopy (SEM). Other characterization such as XPS, TGA, DSC, etc were also performed. It was found that a segregated network morphology gave a lower percolation threshold and outstanding conductivity and EMI shielding properties.