Polyurethane/carbon nanotube nanocomposite foams prepared with supercritical CO_2 for efficient EMI reduction

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The steady growth of communication technology has recently raised some questions about the adverse effects of electromagnetic waves radiations on the human body. These waves also generate interference problems to medical apparatus and many other electronic instruments. There is thus a growing interest for efficient shielding materials to protect people and those apparatus from the electromagnetic wave pollution. In that context, polymer/multi-walled carbon nanotubes (MWNT) nanocomposites are proposed for their high electromagnetic interference (EMI) shielding performance. A promising approach for EMI shielding is to absorb electromagnetic radiations instead of reflecting them. In this work, nanocomposites based on polyurethane (PU) filled with a few percent of MWNTs are foamed by supercritical CO_2 in order to prepare efficient EMI shielding materials. The strategy is to render the polymer conductive by adding MWNTs and to promote wave absorption by foaming the polymer-based composite. The nanocomposites prepared by melt blending are characterized by transmission electron microscopy (TEM) and rheology in order to evaluate the quality of nanofiller dispersion. The nanocomposites foamed with $scCO_2$ are then analyzed by scanning electron microscopy (SEM) in order to investigate the uniformity of the cellular structure. EMI shielding efficiency as high as 60-80 dB together with a low reflectivity is observed at a low content of MWNTs (up to 2 wt%). The reflectivity of the nanocomposites is advantageously decreased upon foaming. These MWNT/PU polymeric foams thus show a promising EMI shielding efficiency due to their high capacity to absorb electromagnetic radiation at low MWNT content.