APPLICATION FOR THE PURPOSE OF POLYMER/CARBON NANOTUBE FOAMED BY SUPERCRIRICAL CO_2 AND FREEZE-DRYING METHOD

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Thanks to its nontoxic, uninflammable and easy recycle properties, its abundance and cheap price, many researchers has widely used supercritical carbon dioxide ($scCO_2$) fluid as a physical blowing agent for the foaming of different polymer/clay nanocomposites such as: Polypropylene/clay[1,2], polycarbonate/clay[3], polystyrene/clay [4,5], poly(methylmethacrylate) /clay)[5], polylactice/clay[6].

Similarly to clay, carbon nanotubes can play the roles of fillers in polymer; it can efficiently enhance the mechanical properties, impact resistance, and thermal stability of materials [7-8]…Moreover, compared to clay, carbon nanotubes have also the capacity to impart electrical conductivity. For these reasons, CNTs/polymer materials have been widely investigated for EMI shielding purposes. However, a major drawback of these nanocomposites is a high propensity to reflect the electromagnetic radiations rather than to absorb them. Indeed, the reflection of the signals results from a mismatch between the wave impedances for the signal propagating into air and into the absorbing material, respectively. The introduction of air into these nanocomposites by the formation of foam will be favorable to the matching of the wave impedances of the expanded material and the ambient atmosphere.

Poly(methylmethacrylate) (PMMA) and Polycaprolactone (PCL) nanocomposites were foamed in supercritical CO_2 ($scCO_2$) and by freeze-drying method respectively. Two different shapes of cells: close cells with isotropic properties were obtained by $scCO_2$ method; open cells (cylinder shape), and anisotropic properties by the freeze-dying method. The influences of different parameters on morphology have been studied such as the temperature, time and pressure of CO_2 impregnation, the ratio of solvent/polymer, ration of carbon nanotubes in a mixture. The morphology of these foams was investigated by SEM (Scanning Electronic Microscopy).

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