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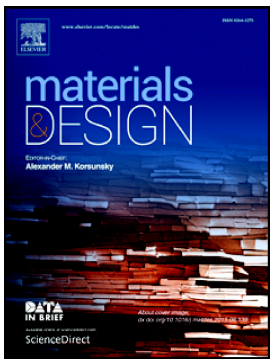

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Low-density microcellular carbon foams from sucrose by NaCl particle templating using glycerol as a plasticizing additive

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Abstract

Carbon-NaCl composites with high NaCl loading (83.3 to 92.2 wt%) were prepared by setting molten sucrose-NaCl-glycerol pastes in a stainless steel mold at 160 ^{o}C. The carbonization of the composites followed by NaCl removal by washing with water produced low-density microcellular carbon foams. The setting of the paste was due to the caramelization of molten sucrose as well as the slow evaporation of glycerol. The carbon-NaCl composites had the adequate compressive strength (6.9 to 17.8 MPa) and ductility for machining using conventional machine tools. Machining of the carbon-NaCl composites followed by NaCl removal was used as a strategy to produce low-density carbon foams with desired contours. The glycerol not only decreased the density of carbon foams produced from the sucrose-NaCl system but also produced a remarkable change in the foam microstructure from a combination of macropores and microcells to only microcells of sizes predominantly in the range of 3 to 6 μm. Carbon foams prepared at NaCl to sucrose weight ratios in the range of 1.5 to 3 show density, compressive strength, thermal conductivity and EMI shielding effectiveness in the ranges of 0.096 to 0.214 g/cm^3, 0.60 to 4.83 MPa, 0.087 to 0.235 Wm^{-1}K^{-1} and 24.7 to 41.7 dB, respectively.

Keywords Sucrose; Carbon foams; Cell size; Electromagnetic shielding; Machinability; Thermal conductivity

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