A micromechanics-based parametric study on the electrical and heating behavior of porous nanocomposites incorporating carbon nanotubes

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Abstract

Carbon nanotubes have an electrical conductivity similar to metallic materials and its addition to nanocomposites can create the electrical conductive pathways (Kim et al., 2016). This type of nanocomposites has a semiconductor-like electrical conductivity and can generate heat via Joule heating mechanism upon the supply of input voltage to the composites (Kim et al., 2016). The formation of conductivity pathway in nanocomposites particularly depends on the air porosity (Kalaitzidou et al., 2007). Herein, the parametric effects of air porosity on the electrical properties are investigated through micromechanics-based simulations (Yang et al., 2016). In the present model, the air porosity are described as spherical voids, and the material properties of constituent phases are properly applied for the numerical simulations in order to capture the experimental conditions (Lee et al., 2014; Yang et al., 2016). The simulation results reveal that increase in the air porosity adversely influences the electrical and heating performance of composites, which can cause an overall electrical degradation of nanocomposites (Yang et al., 2016).

Keywords: Carbon nanotube-incorporated composites, Electrical conductivity, Micromechanics, Air porosity.

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