Effect of CNT on microstructural properties of Zn2SiO4/CNT composite via dry powder processing

ABSTRACT

This work focused on the influence of carbon nanotubes(CNT)to the microstructural properties of Zn2SiO4/CNT (ZSO/CNT) composite. CNT was synthesized via alcohol catalytic chemical vapor deposition (ACCVD) using cobalt oxide as catalyst and ethanol as carbon source. Zinc silicate (ZSO)glass was prepared from quenching the melted commercial waste glass bottle with zinc oxide powder. ZSO/CNT-x composites with various CNT concentration (0, 1, 2 and 3 wt%)was prepared through introducing CNT into ZSO glass via dry processing technique followed by sintering process in Argon gas(Ar) environment and atmospheric (atm) environment, respectively. FESEM, XRD and EDS were employed to determine the surface morphology, phase composition and elemental distribution of sintered sample. Crystallite trigonal willemite (Zn2SiO4) phase was observed from argon sintered sample and the crystallite size of willemite phase in ZSO/CNT-3/Ar showed the most reduced lattice strain of 22.85% compared to ZSO/CNT-0/Ar. In contrast, semi crystalline phase exhibited in atmospheric sintered sample resulted in high lattice strain. It is concluded that dry powder processing and inert gas thermal treatment can be an effective technique in fabricating strain-reduced ceramics/ CNT composite without alternating the domain phase. Least internal strain in crystal lattice have potential on enhancing the luminescence properties of phosphor material and lattice thermal conductivity of thermoelectric material.

Keyword: Carbon nanotubes; Zinc silicate; Crystallite size; Lattice strain; Willemite