

Dielectric behavior of β -SiC nanopowders in air between 30 and 400 °C

ABSTRACT

Silicon carbide (SiC) is regarded as a semiconductor and thus characterized mainly for its electrical conductivity. However, SiC does exhibit significant electrical resistance at low ambient temperatures and represents a possible dielectric insulator. In this paper, the dielectric properties of the β -SiC nanopowders were examined by X-ray diffraction and dielectric spectroscopy within the humid Malaysian environment. Research emphasis is placed on the stable dielectric behavior of the nanopowder itself as the nanopowder phase is susceptible to hydroxyl oxidization as mentioned by the nanopowder manufacturer. The XRD results identified the presence of β -SiC peaks whereas EDX detected minor oxygen presence in the nanopowder. Dielectric permittivity response of the nanopowder pellet indicated stable Quasi-DC dielectric behavior from 30 to 400 °C with minor increments of the initial relative dielectric permittivity at the lower temperatures. The relative dielectric permittivity of the SiC nanoparticles was determined to be 44 (30 °C) to 31 (400 °C) at 1 MHz. Arrhenius plot of the dielectric data resulted in a two linear energy activation plots due to possible hopping mechanisms within the SiC nanoparticles covalent structure. Overall, the β -SiC nanopowder exhibited a stable Quasi-DC behavior at the measured temperatures.

Keyword: β -SiC nanopowders; Dielectric behavior; Temperatures; Air