

Influences of Sn Doping and CaTiO₃ Volume Fraction on Microstructure and Electrical Response of Sn-doped CaCu₃Ti₄O₁₂/CaTiO₃ Composites

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The influences of Sn doping concentration and CaTiO₃ volume fraction on microstructure and electrical response of Sn-doped CaCu₃Ti₄O₁₂/CaTiO₃ composites prepared from a nominal formula of Ca_{1+x}Cu_{3-x}Ti_{4-y}Sn_yO₁₂ (where $x = 0, 0.5, 1$ and 1.5 ; $y = 0.05$ and 0.30) were investigated. The dielectric properties of CaCu₃Ti₄O₁₂/CaTiO₃ composites were measured as functions of frequency and temperature. The n-type semiconducting grains of CaCu₃Ti₄O₁₂ phase and insulating interfaces between CaCu₃Ti₄O₁₂-CaCu₃Ti₄O₁₂ grains and CaCu₃Ti₄O₁₂-CaTiO₃ grains were studied by an impedance spectroscopy technique. The microstructure of Ca_{1+x}Cu_{3-x}Ti_{4-y}Sn_yO₁₂ ceramics was slightly changed with increasing CaTiO₃ volume fraction. The dielectric properties were strongly affected by Sn content and the volume fraction of CaTiO₃. At 1 kHz, the dielectric constant (ϵ') increased with increasing Sn doping concentration. It was also found that ϵ' decreased with increasing CaTiO₃ volume fraction. The activation energy for conduction within the grains slightly increased with increasing the Sn content; whereas, the activation energy for conduction at the internal interfaces decreased slightly. Interestingly, it was found that Egb increased significantly with increasing CaTiO₃ volume fraction.

Summary

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