

The effect of  $\text{Sm}_2\text{O}_3$  on the microstructure and electrical properties of  $\text{SiO}_2$ -doped  $\text{SnO}_2\text{-Zn}_2\text{SnO}_4$  ceramic varistors

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**The effect of  $\text{Sm}_2\text{O}_3$  on the microstructure and electrical properties of  $\text{SiO}_2$ -doped  $\text{SnO}_2$ - $\text{Zn}_2\text{SnO}_4$  ceramic varistors**

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**Abstract:**

In this work,  $\text{Sm}_2\text{O}_3$ - and  $\text{SiO}_2$ -codoped  $\text{SnO}_2$ - $\text{Zn}_2\text{SnO}_4$  ceramic varistors were prepared through traditional ceramic processing, and the effect of  $\text{Sm}_2\text{O}_3$  on the resulting microstructure and electrical properties was investigated. The results demonstrated that the ceramics were composed mainly of  $\text{SnO}_2$  and  $\text{Zn}_2\text{SnO}_4$ , and Sm was distributed homogeneously in the grains and along the grain boundaries. With 0.2 mol%  $\text{Sm}_2\text{O}_3$  doping, the grain growth was obviously promoted. Further increases in  $\text{Sm}_2\text{O}_3$  to 0.4 mol% resulted in trace amount of  $\text{SiO}_2$  and segregations containing elemental Sm via X-ray diffraction patterns and microstructure photos, respectively. In the sample doped with 0.3 mol%  $\text{Sm}_2\text{O}_3$ , optimal electrical characteristics of  $\alpha=9.4$ ,  $E_B=10$  V/mm,  $J_L=46$   $\mu\text{A}/\text{cm}^2$  and  $\varepsilon'=1.2\times 10^4$  were obtained. Simultaneously, the sample doped with 0.3 mol%  $\text{Sm}_2\text{O}_3$  had the lowest conductance activation energy of 0.16 eV at temperatures lower than 110°C. This good performance indicates that  $\text{Sm}_2\text{O}_3$ - and  $\text{SiO}_2$ -codoped  $\text{SnO}_2$ - $\text{Zn}_2\text{SnO}_4$  composite ceramics are viable candidate for the manufacture of capacitor-varistor functional devices.

**Key words:** varistors; electroceramics; dielectric properties

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