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V_2O_5对 $BaTiO_3$-Y_2O_3-MgO陶瓷性能的影响

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摘要 研究了V_2O_5掺杂$BaTiO_3$-Y_2O_3-MgO系陶瓷的显微结构和介电性能. SEM显示V_2O_5会促进该体系晶粒生长, 降低陶瓷致密度. XRD显示V掺杂样品均为单一赝立方相, 其固溶度>1.0mol%. 研究表明, V离子能有效抑制掺杂离子Y、Mg向$BaTiO_3$晶粒内扩散, 改变掺杂离子在晶粒中分布, 从而形成薄壳层的壳芯晶粒, 因此V能提高居里峰的强度并改善电容温度稳定性. 多价V离子在还原气氛中以+3、+4为主, 能增强瓷料的抗还原性, 提高绝缘电阻率($10^{13}\Omega\cdot cm$)、降低介电损耗(0.63%). 该体系掺杂0.1mol%V时, 介电常数达到2600, 满足X8R标准.

关键词 钛酸钡 五氧化二钒 显微结构 介电性能 多层陶瓷电容器

分类号 TM534

Influence of V_2O_5 on the Properties of $BaTiO_3$-Y_2O_3-MgO Ceramics

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Abstract

The microstructure and dielectric properties of V_2O_5-doped $BaTiO_3$-Y_2O_3-MgO ternary system were studied. SEM shows that V ions can promote grain growth of $BaTiO_3$ based ceramics, but decrease the density of sintered ceramics. XRD indicates that V-doped samples have pseudocubic structure and the solubility limit of V is more than 1.0mol%. The results show that V can increase the intensity of Curie peak and improve the temperature stability of dielectric constant, because of the formation of core-shell-grains with thin shell layer, which is attributed to the fact that V ions can effectively inhibit the diffusion of Y and/or Mg ions into $BaTO_3$ grains and change the distribution of doping ions in the grains. Moreover multivalent V ions can reinforce the nonreducibility of this system, and the insulation resistivity increases to $10^{13}\Omega\cdot cm$ and dielectric loss decrease to 0.63% consequently. The high performance materials with dielectric constant of 2600 satisfying the X8R requirement is achieved when 0.1mol% V is added.

Key words BaTiO3 V2O5 microstructure dielectric properties multilayer ceramic capacitor

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