

Dielectric properties of (Ca,Eu)Cu₃Ti₄O₁₂ ceramics prepared by a sol-gel method

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The ACu₃Ti₄O₁₂ (where A = Ca, Sr, Ba) material belongs to the oxides with perovskite-based structure. The CaCu₃Ti₄O₁₂ was first synthesized in 1967 by Alfred Deschanvres, but no physical properties were measured until 2000, when it was found that this material - in the form of bulk ceramics - exhibits giant dielectric permittivity values as high as 10,000 for frequencies up to 1 MHz. However, the origin of this phenomenon is still not well understood. One suggested explanation is the mixed valence state of copper and/or the presence of secondary phases that are always formed during the synthesis (some authors proposed that the CaCu₃Ti₄O₁₂ is not stoichiometric). In any case, as acknowledged in other perovskite dielectrics, partial or full substitution in the ABO₃ stoichiometry can lead to a significant change in dielectric characteristics. Possible substitution of the alkaline earth metals in a dodecahedral position by europium(II), showing similar ionic radius and electronegativity but differing in valence shell configuration, has not been studied yet.

In this work, we focused on the mixed (Ca,Eu)Cu₃Ti₄O₁₂ perovskite prepared by the Pechini polyesterification sol-gel method. The powder precursors were pressed and sintered in air at different temperatures (1000, 1050, 1100 and 1120 °C) to obtain the desired ceramics. The phase composition of the ceramics was determined by XRD and the thermal behavior was measured by means of thermal analysis. Further, the microstructure and dielectric properties of the material were studied.

This work was financially supported by SGS20/058/OHK3/IT/13 and specific university research (MSMT No 21-SVV/2020).