MceMeim10-001

Phases evaluation of CaCu3Ti4O12-based powders calcined in different atmospheres

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CaCu3Ti4O12-based ceramics (CCTO) present dielectric constant values (?) much higher (? > 104) than those observed for conventional materials, which is a consequence of the microstructure formed by semiconductor grains and insulating grain boundaries based on a CuO rich phase. The model known as Internal Barrier Layer Capacitor (IBLC) currently constitutes a well-established proposal to explain the extraordinary dielectric constant values of this material, but it is insufficient to fully elucidate the CCTO dielectric behavior. The literature shows that there is a great influence of the preparation method of this material on the final dielectric properties of CCTO ceramics. In this study, was evaluated the influence of the atmosphere used in calcination of CaCu3Ti4O12 powders in its dielectric properties. In this way, CaCu3Ti4O12 powders were synthesized by the coprecipitation method followed by the calcination process using different atmospheres. The calcination was carried out in a resistive furnace at 850, 950 and 1000 °C for 6 h at different oxidizing atmospheres (atmospheric air or pure O2). Structural characterizations of powders were performed by X-ray diffraction analysis (XRD), morphological characterizations of ceramics powders were accomplished by scanning electron microscopy (SEM) associated with energy dispersive spectroscopy (EDS). Thus, it was possible to evaluate the influence of the calcination atmosphere on the CCTO, CuO, TiO2 and CaTiO3 phases amount formed on the CCTO powders. Also, for both atmospheres, CaCu3T4O12 powders calcinated at 1000 °C, showed the highest mass fraction of CCTO phase, 96.3 wt%, while the sample sintered at 850 °C in atmospheric air had 77.0 wt%. The micrographs showed a narrow particles size distribution for ceramics calcinated at 850 °C, presenting spherical and very agglomerated morphology, with D50 = 445 nm and 419 nm for powders calcinated in atmospheric air and O2, respectively. CCTO particles showed an expressive growth when calcinated at 1000 °C in atmospheric air, presenting D50 = 1880 nm.