Carrier Diffusion Model for Electrical Conductivity Response of Bi₃TiNbO₉ to Ambient Humidity

RICARDO E. AVILA, DMN, CCHEN, Cas. 188-D, Santiago, Chile, ALICIA CASTRO, ICMM, CSIC, Madrid, Espaa, DANIEL SERAFINI, HCTOR ULLOA, Depto. de Fsica, USACH, Santiago, Chile — The electrical properties of the metastable phase of Bi₃TiNbO₉ isomorphic to δ-Bi₂O₃, in ceramic pellet form have been established. Pellets are formed by mechanochemical activation (1 to 48 h in an SPEX 8000 automatic mill), and uniaxial pressing, leading to the metastable phase in the 310 to 490 °C, as the activation time increases. Correspondingly, the stable Aurivillius phase forms in the 500 to 600 °C range. The current through pellets with ~10 nm thick sputtered Pt electrodes increase by factors between 10 an 2000 in a transient from dry air to dew point of 10 °C at room temperature. The response time (10% to 90% of the current rise) is in the 15 to 30 s range, and it does not deteriorate under saline ambient, nor does it depend on the dry carrier gas (air, Ar, N₂, O₂, or 0.1% H₂ / He). A bulk carrier diffusion model achieves a close qualitative fit to the current response to bias and humidity cycling.

1Supported by Fondecyt Grant 1040213