Title: Solid state synthesis of lead-free Sm-doped $Na_{0.5}Bi_{4.5}Ti_4O_{15}$ ceramics for enhanced dielectric and electrical properties.

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Abstract: Here we report the synthesis of Sm-doped $Na_{0.5}Bi_{4.5}Ti_4O_{15}$ ($Na_{0.5}Sm_{0.5}Bi_4Ti_4O_{15}$) lead-free ceramics via a conventional solid-state technique. Investigations of $Na_{0.5}Bi_{4.5}Ti_4O_{15}$ (NBT) and $Na_{0.5}Sm_{0.5}Bi_{4.5}Ti_4O_{15}$ (NSBT) ceramics were demonstrated in detail to understand the composition-based structure-property of Aurivillius compounds and related functional material. Dielectric properties for frequency and temperature in a wide range were analyzed. The conduction activation energy values of NSBT ceramics are obtained to be 1.40 eV, whereas, the NBT ceramics get the value to be 1.31 eV. At higher temperatures, the conduction activation energy value of NSBT ceramics is 1.32 eV for both frequencies of 100 Hz and 1 kHz, whereas, for NBT compounds, the calculated value is 1.27 eV for both frequencies. The simulation performed on the impedance data for capacitive and resistance elements shows well-fitting curves which indicates a single relaxation behavior in the material. Similarly, the *AC*-conductivity data were analyzed which gives different conduction processes and relaxation activation energies in the NSBT ceramics.

Keyword: Na0.5Sm0.5Bi4Ti4O15, Dielectric, Aurivillius-Ceramics, Na0.5Bi4.5, Ceramics.

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