Polarized Micro-Raman Spectroscopy of Oriented Microwave A(B'1/3B"2/3)O3 Electroceramics

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Abstract

A(B1/3B2/3)O3 ceramics exhibit remarkable microwave dielectric properties for use as resonators in telecommunication devices. In these materials, the optical phonons determine their dielectric response, which in turn depends on the preparation conditions. In this respect, the hydrothermal technology appears as the most promising route for environmentally friendly and low-cost production of advanced ceramics. A recent innovation in this technology was the introduction of microwaves into the reaction vessels to produce materials with different structural and morphological characteristics from the conventional powders. In this work, we report the phonon properties of A(B1/3B2/3)O3 (A=Ba or Sr, B=Mg, Mn or Zn and B=Nb) powders synthesized by microwave-hydrothermal process. Oriented and large needle-like crystals were carefully produced for examination by polarized micro-Raman spectroscopy. The complete assignment of the vibrational modes as a function of chemical composition in A(B1/3B2/3)O3 ceramics was carried out through the analysis of the peak evolutions besides factor-group predictions. Scanning electron microscopy and Fourier-transform infrared spectroscopy were employed to show the morphological characteristics of the microwave-hydrothermal powders, as well as to correlate the phonon vibrations with the dielectric properties in the microwave region.