Exploring the effect of particle concentration and irradiation time in the synthesis of barium strontium titanate (bst) ba(1-x)srxtio3 (x:0-1) nanoparticles by high power ultrasonic irradiation

Erlina Yustanti, author

Abstrak

Barium strontium titanate (BST) or Ba1-xSrxTiO3 with x=0-1 possesses superior dielectric properties, which are widely used in many applications like in communication technology, electronic instrumentations, and various electrical devices. In this paper, the characterization of the particle and crystallite size of Ba1-xSrxTiO3 (x: 0; 0.3; 0.7) is described. A two-step refinement commenced: first by mechanical milling, and then a further refinement under ultrasonic irradiation in a high power sonicator was applied to Ba1-xSrxTiO3 (x: 0; 0.3; 0.7) particles. The crystalline powders were obtained through mechanically alloyed standard research grade BaCO3, TiO2, and SrCO3 precursors in a planetary ball mill.The powders were first found heavily deformed after 60 hours of milling and then went through a sintering process at 1200°C for 4 hours to form multicrystallite particles. The presence of a single phase in the three samples was solidly confirmed in their respective X-ray diffraction (XRD) patterns. The changes of multicrystallite particles into monocrystallite particles were obtained only after crystalline powders were irradiated ultrasonically in a high power sonicator. The processing variable during ultrasonic irradiation was limited to the duration time of irradiation and particle concentration in the exposed media. It is shown that the average sizes of BST particles at x=0; 0.3; 0.7 before ultrasonic irradiation were 353, 348, and 385 nm, respectively. These respective sizes decreased drastically to 52, 35, and 49 nm, respectively, after 12 hours of ultrasonic irradiation. These particle sizes are almost identical with that of their crystallite size. Hence, the synthesis of monocrystallite particles has been achieved. As the particle concentration of media takes effect, it is shown that an exposed media with a higher particle concentration tends to form multicrystallite particles.