The influence of BaGeO₃ on the properties of Ba(Ti_{1-x}Sn_x)O₃ ceramics on the basis of sol-gel powders

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Abstract

Ba(Ti_{1-x-y}Sn_xGe_y)O₃ (BTSG-*x-y*; *x* = 0, 0.05; *y* = 0–0.05) powders were synthesized by a sol-gel (SG) method and for comparative purposes also by a mixed-oxide (MO) method. In this system, BaGeO₃ functions as sintering additive. Due to smaller particle sizes of the SG powders a higher sintering activity was found, which resulted in reduced grain growth and in a more homogenous grain size distribution for the corresponding ceramics. The dependence on the paraelectric ⇌ ferroelectric phase transition, i.e. the phase transition temperature, the width of the transition region and completeness were examined by dielectric measurements, DTA as well as by SEM, EDX and XRD investigations with respect to the BaGeO₃ content, synthesis method and sintering temperature. The phase transition temperatures of the SG ceramics are remarkably higher than those of the MO ceramics with the same nominal compositions. The reason is a lower tin concentration within the grains of SG ceramics as confirmed by EDX and XRD investigations. The presence of BaGeO₃ in barium titanate–stannate system on the basis of a SG method caused an improved incorporation of tin in the BaTiO₃ lattice.