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Low-firing Behavior, Microstructure, and Electromagnetic Properties of a Ferroelectric-Ferromagnetic Composite Material with Multiple Doping

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Abstract: A series of $BaTiO_3$-$Ni_{0.62}Cu_{0.25}Zn_{0.16}Fe_{1.98}O_4$ ferroelectric-ferromagnetic composites with Li_2CO_3-V_2O_5-Bi_2O_3 multiple doping were prepared by the solid-state reaction at 900°C~1000°C, and the low fired (< 961°C) samples can adapt to the low temperature cofired ceramic (LTCC) technology. The relative density of all sintered composites was higher than 96%, and particularly for the low fired composites, it was in the range of 97.1%~99.5%. The variation of magnetic properties with $BaTiO_3$ content was investigated combining with microstructure and two types of magnetization (demagnetization) processes. A novel method for calculating the microstructure parameter δ^*/D of the multiple doping composite systems has been deduced so that the magnetic circuit model can be used to predict the magnetic properties of the composites, and the experimental results matched well with the fitting curve. The dielectric behavior of the composites has been investigated in non-dispersive region (10^6~10^8Hz) and dielectric dispersion region (10^8~10^{10}Hz). Through combing grain size effect and phase transition, the influence of sintering temperature and $BaTiO_3$ content on permittivity ε' and dielectric dispersion of the

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