

Dielectric Properties of Nano-crystalline BaTiO₃ Synthesized by Micro-emulsion Method

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Abstract

Ferroelectricity of the thin films consisting of nano-crystalline BaTiO₃ by micro-emulsion method was investigated. Ultra-fine BaTiO₃ particle of 8nm in diameter was obtained. A clear solution of the well-dispersed powder was spin-coated on Si/SiO₂/Al₂O₃/Pt substrate. The crystallinity and particle size were changed with post annealing from 600C to 1000C. Dielectric properties of the films were measured as a function of bias voltage, frequency and temperature. It was revealed from evaluation of dielectric properties and microstructure that annealing at higher than 700C provided BaTiO₃ thin film with ferroelectricity. Typical ferroelectric D-E hysteresis was observed with thin films of 360nm thick fired at 700C. The ceramic consists of the fine-grains of 18nm in diameter. Dielectric constant and dissipation factor were 770 and 2.4%, respectively. The grain growth was taken place with elevating the heating temperature. But the grain growth was not as serious as expected. The sample fired at 1000C had still fine grain size of 67nm. The insulation resistance was higher than 10⁹ ohm-cm, which is an acceptable value for capacitor applications.