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Rare-earth substitution in $Bi_4Ti_3O_{12}$ system for potential application

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Introduction

Nowadays, rare-earths have been generally used as substitution element in bismuth titanate (BIT), $Bi_4Ti_3O_{12}$ due to their remarkable improvement in the dielectric and ferroelectric properties. Partial substitution of volatile Bi ions by suitable trivalent rare-earth ions in BIT could reduce the intrinsic defects such as oxygen vacancies. Thus, the enhanced stability of the oxygen in the Ti–O octahedron layer is caused by the substitution of rare-earth ions for the volatile Bi ions located near the Ti–O octahedron layer [1].

Materials and methodology

Starting materials consist of Bi nitrate pentahydrate, Ti(IV) isopropoxide, Nd nitrate hydrate and Sm nitrate hexahydrate. Each rare-earth element was added into Bi-Ti solution with 0.25, 0.50, 0.75 and 1.0. The prepared solution was stirred (60°C) and then, evaporated (80°C). The evaporated powder was heated at temperature ~250°C in order to form the as-combusted powder. Sintering temperature was set at 1000°C for 3 hour to produce the ceramic samples. The dielectric and ferroelectric properties were measured using *LCR meter* and *Sawyer Tower circuit*, respectively.

Results and discussion

Figure 1 shows the dielectric properties of Nd and Sm substitution systems at 1 MHz. As seen, the dielectric constant, ε_r, was greatly increased with rare-earth substitution and molarities content. The remanent polarization, P_r and coercive field, E_c of both substitution systems is illustrated in Figure 2, which are important parameters for memory technology. Details of discussion will be reported in the full paper.