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PII: S0955-2219(17)30469-7
DOI: http://dx.doi.org/doi:10.1016/j.jeurceramsoc.2017.06.046
Reference: JECS 11350

To appear in: *Journal of the European Ceramic Society*

Received date: 18-2-2017
Revised date: 20-6-2017
Accepted date: 24-6-2017

Please cite this article as: Du Guoping, Wei Fangbin, Li Wang, Chen Nan.Co-doping effects of A-site Y3+ and B-site Al3+ on the microstructures and dielectric properties of CaCu3Ti4O12 ceramics.*Journal of The European Ceramic Society* http://dx.doi.org/10.1016/j.jeurceramsoc.2017.06.046

Co-doping effects of A-site Y^{3+} and B-site Al^{3+} on the microstructures and dielectric properties of $CaCu_3Ti_4O_{12}$ ceramics

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Abstract

Different doping elements have been used to reduce the dielectric losses of $CaCu_3Ti_4O_{12}$ ceramics, but their dielectric constants usually are undesirably decreased. This work intends to reduce their dielectric losses and simultaneously enhance their dielectric constants by co-doping Y^{3+} as a donor at A site and Al^{3+} as an acceptor at B site for substituting Ca^{2+} and Ti^{4+}, respectively. Samples with different doping concentrations x = 0, 0.01, 0.02, 0.03, 0.05 and 0.07 have been prepared. It has been shown that their dielectric losses are generally reduced and their dielectric constants are simultaneously enhanced across the frequency range up to 1 MHz. The doped sample with x = 0.05 exhibits the highest dielectric constant, which is well over 10^4 for frequency up to 1 MHz and is about 20% higher than the undoped sample. Impedance spectra indicate that the doped samples have much higher grain boundary resistance than the undoped one.

Keywords: $CaCu_3Ti_4O_{12}$; co-doping; dielectric property; colossal dielectric constant ceramic