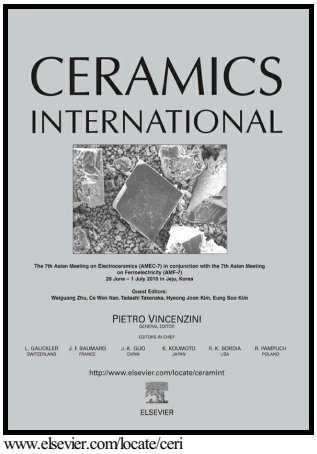

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Conductivity- Permittivity Relations in oxygen deficient $CaCu_3Ti_4O_{12}$

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Abstract

The correlation between conductance, capacitance and oxygen content is discussed in the colossal dielectric permittivity perovskite oxide $CaCu_3Ti_4O_{12}$. We found an unusual positive conductivity- permittivity relation which is very sensitive to the oxygen content. In particular, we ascribe the oxygen content sensitivity of both the capacitance and the conductance to a repositioning of charges on oxygen vacancy related defects and/or on the migration of the defects themselves. We find that in the charge repositioning process a Jonscher type of global conduction is accompanied by a Debye-type local electronic relaxation in and between the boundaries of a specific grain. A closer investigation of these processes suggest that the local polaronic relaxation of charges on oxygen vacancy related defects is mainly responsible for the large dielectric constant of $CaCu_3Ti_4O_{12}$ and also for the ac conduction at low to medium temperatures.

Key words: conductivity-permittivity relation, oxygen vacancy, $CaCu_3Ti_4O_{12}$, defect