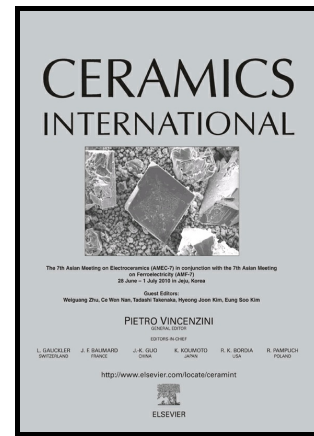


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## Interfacial origin of enhanced energy density in SrTiO<sub>3</sub>-based nanocomposite films

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**Abstract:** SrTiO<sub>3</sub>-based films doped with different Al-precursors were prepared by sol-gel methods and the dielectric strengths and leakage currents of the materials were investigated. The best performance was found in SrTiO<sub>3</sub> films doped with Al<sub>2</sub>O<sub>3</sub> nanoparticles (nano-Al<sub>2</sub>O<sub>3</sub>). When 5 mol% of nano-Al<sub>2</sub>O<sub>3</sub> was added to SrTiO<sub>3</sub> films with Al electrodes, the dielectric strength was enhanced to 506.9 MV/m compared with a value of 233.5 MV/m for SrTiO<sub>3</sub> films. The energy density of the 5 mol% nano-Al<sub>2</sub>O<sub>3</sub> doped SrTiO<sub>3</sub> films was 19.3 J/cm<sup>3</sup>, which was also far higher than that of the SrTiO<sub>3</sub> films (3.2 J/cm<sup>3</sup>). These results were attributed to interfacial anodic oxidation reactions, which were experimentally confirmed by cross-sectional transmission electron microscope studies and theoretically modelled based on Faraday's laws. The films with added nano-Al<sub>2</sub>O<sub>3</sub> featured many conducting paths at the interfaces between the host phase and the guest nano-Al<sub>2</sub>O<sub>3</sub>, which promoted ion transport and contributed to the strong anodic oxidation reaction capability of the 5 mol% nano-Al<sub>2</sub>O<sub>3</sub> doped SrTiO<sub>3</sub> films.

**Keywords:** Dielectric strength, Leakage current, Energy density, Interfacial effect, Anodic oxidation.

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