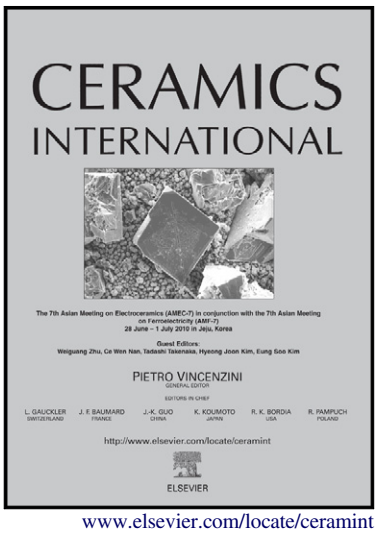

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Effect of LiF addition on phase structure and piezoelectric properties of $(Ba,Ca)(Ti,Sn)O_3$ ceramics sintered at low temperature

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Abstract

In this study, a series of $(Ba_{0.95}Ca_{0.05})(Ti_{0.90}Sn_{0.10})O_3$-$x$LiF (BCTS-$x$LiF) ($0 \le x \le 6$ mol%) lead-free piezoceramics were fabricated by conventional solid-state reaction method. The incorporation of LiF could significantly improve the sinterability of BCTS ceramics by reducing the sintering temperature from 1480 °C to 1250 °C, where a relative density over 90% was achieved with grown grains of 5-20 μm. X-ray diffraction and Raman spectroscopy experiments revealed that BCTS-xLiF ceramics are composed of coexisting *R*-*O*-*T* phases at $0 \le x \le 1$ and *R*-*T* phases at $2 \le x \le 6$ at room temperature. Optimal piezoelectric properties of d_{33}=510 pC/N, k_p=40.9%, ε_r=5370, $tan\delta$=0.019 and dS/dE=961 pm/V were obtained at x=5, which is attributed to the coexistence of *R* and *T* phases with an optimum ratio at room temperature and dense structure with large grains.

***Keywords*:** BCTS; LiF addition; Low-temperature sintering; Piezoelectric properties

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