

流延成型制备 $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ 陶瓷的显微结构及性能

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摘要

采用流延成型工艺制备了 $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ 无铅压电陶瓷, 研究了陶瓷退火前后的显微组织结构, 结果表明陶瓷主晶相为钙钛矿相结构, 并伴随有形貌呈针状的第二相 $\text{K}_2\text{Ti}_6\text{O}_{13}$ 出现; 陶瓷断面和表面的晶粒形貌有差别, 采用退火处理无法消除第二相 $\text{K}_2\text{Ti}_6\text{O}_{13}$, 但可有效改善陶瓷断面的晶粒形貌, 同时增大材料的矫顽场, 并使剩余极化强度(P_r)、压电常数(d_{33})、介电常数(ϵ)与介电损耗($\tan\delta$)变小. $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ 无铅压电陶瓷的电滞回线表现出明显铁电体的特征, 其矫顽场为2680V/mm, P_r 达 $36.6\mu\text{C}/\text{cm}^2$, d_{33} 达113pC/N, K_p 为0.27, Q_m 达154.

关键词 [无铅压电陶瓷](#) [显微组织](#) [流延成型](#) [压电性能](#)

分类号

Microstructure and Piezoelectric Properties of $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ Lead-free Ceramics Prepared by Tape Casting Processing

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Abstract $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ lead-free piezoelectric ceramics were prepared by tape casting process. The effects of heat-treatment on the microstructure and piezoelectric properties of ceramics were investigated. The results show that the ceramics with densified microstructure can be prepared by tape casting process. The microstructure of cross section is not the same dense as that of surface. There are two phases coexist in the ceramics: perovskite phase and $\text{K}_2\text{Ti}_6\text{O}_{13}$ phase whose appearance is whisker shape. It is difficult to eliminate $\text{K}_2\text{Ti}_6\text{O}_{13}$ by heat-treatment process. But heat-treatment will improve the microstructure of cross section effectively and decrease piezoelectric constant d_{33} , dielectric constant and ϵ dielectric loss $\tan\delta$. $(\text{Na}_{0.85}\text{K}_{0.15})_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ (lead-free piezoelectric ceramics show obvious characteristic of ferroelectrics with coercive electric field E_c 2680V/mm and remnant polarization P_r $36.6\mu\text{C}/\text{cm}^2$, d_{33} , K_p and Q_m of ceramics are 113pC/N, 0.27 and 154 respectively.

Key words [lead-free piezoelectric ceramics](#) [microstructure](#) [tape casting](#) [piezoelectric properties](#)

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