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反应烧结技术制备铌镁酸铅压电陶瓷

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摘要:采用反应烧结工艺制备铌镁酸铅陶瓷, 研究不同Mg源反应物对陶瓷物相组成和微观结构的影响。结果表明, 以MgO为反应物时, 在升温过程中部分PbO未参与反应, 即使在1 200 °C保温4 h后仍会有 $Pb_{1.83}Nb_{1.71}Mg_{0.29}O_{6.39}$ 焦绿石相残留, 对晶粒生长及致密化进程起阻碍作用, 难以在低温下实现高相对密度, 基体晶粒在PbO熔化后通过溶解-析出机制形成近球状形貌。以 $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$ 为反应原料时, 由其热分解所得的MgO具有更为细小的粒度和较高的反应活性, 在850 °C保温1 h即可充分反应获得单一钙钛矿物相, 保温4 h后相对密度可达95%, 晶粒形貌随温度升高从近球状演变成紧密排列的多面体。

关键字: 铌镁酸铅; 压电陶瓷; 反应烧结; 镁源反应物

Preparation of $Pb(Mg_{1/3}Nb_{2/3})O_3$ piezoelectric ceramics by reaction sintering method

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Abstract: $Pb(Mg_{1/3}Nb_{2/3})O_3$ ceramics were prepared by reaction-sintering process. The effect of magnesium precursors on the phase composition and microstructure of ceramics was investigated. The results show that some PbO does not participate in the synthesis reaction when using MgO as a reactant during heating-up process, leading to the residue of $Pb_{1.83}Nb_{1.71}Mg_{0.29}O_{6.39}$ pyrochlore phase even sintered at 1 200 °C for 4 h. The pyrochlore phase retards the grain growth and densification. The high relative density can't be achieved at low temperature. After melting of PbO, the nearly spherical grain morphology is formed through dissolving-precipitating mechanism. When $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$ reactant is used, fine MgO with high reactive activity is obtained from its composition. The completion of reaction to obtain single-phase perovskite is achieved at 850 °C for 1 h. The relatively density is 95% sintered at 850 °C for 4 h. The polyhedral-shaped grains arranging tightly are formed during heating-up process

Key words: $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$; piezoelectric ceramics; reaction-sintering process; magnesium precursor

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