

# Synthesis, characterization and structural study of perovskite ceramics for piezoelectric applications

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**Abstract :** In this work we have prepared lead-free ceramics  $\text{BaTiO}_3$ ,  $\text{CaTiO}_3$  and  $\text{Ba}_{0.85}\text{Ca}_{0.15}\text{Ti}_{0.9}\text{Zr}_{0.1}\text{O}_3$  successfully from different raw materials barium carbonate ( $\text{BaCO}_3$ ) calcium carbonate ( $\text{CaCO}_3$ ) dioxide of titanium ( $\text{TiO}_2$ ) and zirconium dioxide ( $\text{ZrO}_2$ ) by the conventional solid state reaction technique at different sintering temperatures. These materials are mixed for 6 hours and sintered at temperatures of 1200 °C to 1300 °C for 2 hours. The sintering temperature has been varied to study its effects on microstructure and structural properties. Structural parameters were analyzed using X-ray diffraction (XRD), scanning electron microscope (SEM). Differential thermal analysis coupled with thermogravimetric analysis (ATG-ATD) was performed mainly to follow the process of precursor decomposition and formation of the perovskite phase. The XRD analysis results clearly show the synthesis of the perovskite phase as well as highlighting the formation of the  $\text{Ba}_2\text{TiO}_4$  phase in addition to the  $\text{BaTiO}_3$  phase. The diffractogram obtained shows that the BCTZ symmetry is both Cubic with a space group  $\text{Pm-3m}$  and orthorhombic with a space group  $\text{R3m}$ . The calculated phase rates are: 10% and 90% respectively.

**Keywords :** Lead free ceramics, synthesis, microstructure, Perovskite