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Synthesis- structure relationship in lead zirconate titanate PZT elaborated using sol-gel auto combustion approach

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KEYWORDS

PZT, ferroelectric, synthesis, ultrasonic transducer

SHORT SUMMARY

Smart ferroelectric lead zirconate titanate $PbZr_{0.52}Ti_{0.48}$ was synthesized in the morphotropic phase boundary (MPB) by sol-gel auto combustion strategy, which was then calcined at three different temperatures 700, 800 and 900°C for 3h. The obtained PZT was characterized using, SEM, TEM, XRD and TGA. It was deduced that prepared samples can be used as ultrasonic transducers for metrology.

EXTENDED ABSTRACT

Smart ferroelectric lead zirconate titanate $PbZr_{0.52}Ti_{0.48}$ was synthesized in the morphotropic phase boundary (MPB) by sol-gel auto combustion strategy. The as prepared powder was calcined at three different temperatures 700, 800 and 900°C for 3h. The tetragonality of the final product increases with the rise of temperature. Thermal gravimetric analysis (TGA) and differential scanning calorimetric (DSC) depicted the complete crystallization of PZT that was notified at 400°C. Structural, vibrational and microstructure studies were investigated using X-ray diffraction (XRD), Fourier transformer - infrared (FT-IR) and high resolution-transmission electron microscope (HR-TEM, Figure 1) respectively. Results of XRD and HR-TEM were compatible showing the formation of single phase nano- crystalline powder with coexisting of tetragonal and rhombohedral phases. Ritveled refinement of XRD data were carried out using Material Analysis Using Diffraction (MAUD) software in order to obtain the lattice constants. Scanning electron microscope (SEM) and energy dispersive spectroscopy (EDS) were investigated for porosity and elemental analysis. For electrical measurements, disks were uniaxial pressed at 10MPa. The samples were burned out at 500°C for 1 hour then 1100°C for 2 hours to obtain dense disks. The surfaces of the disks were coated with silver paste followed by burning it out for almost 30 minutes. Dielectric and Piezoelectric characteristics for the fabricated PZT samples were determined in details. From theses analytical techniques and collected data, one can deduce that these samples can be used as ultrasonic transducers in various metrological aspects.

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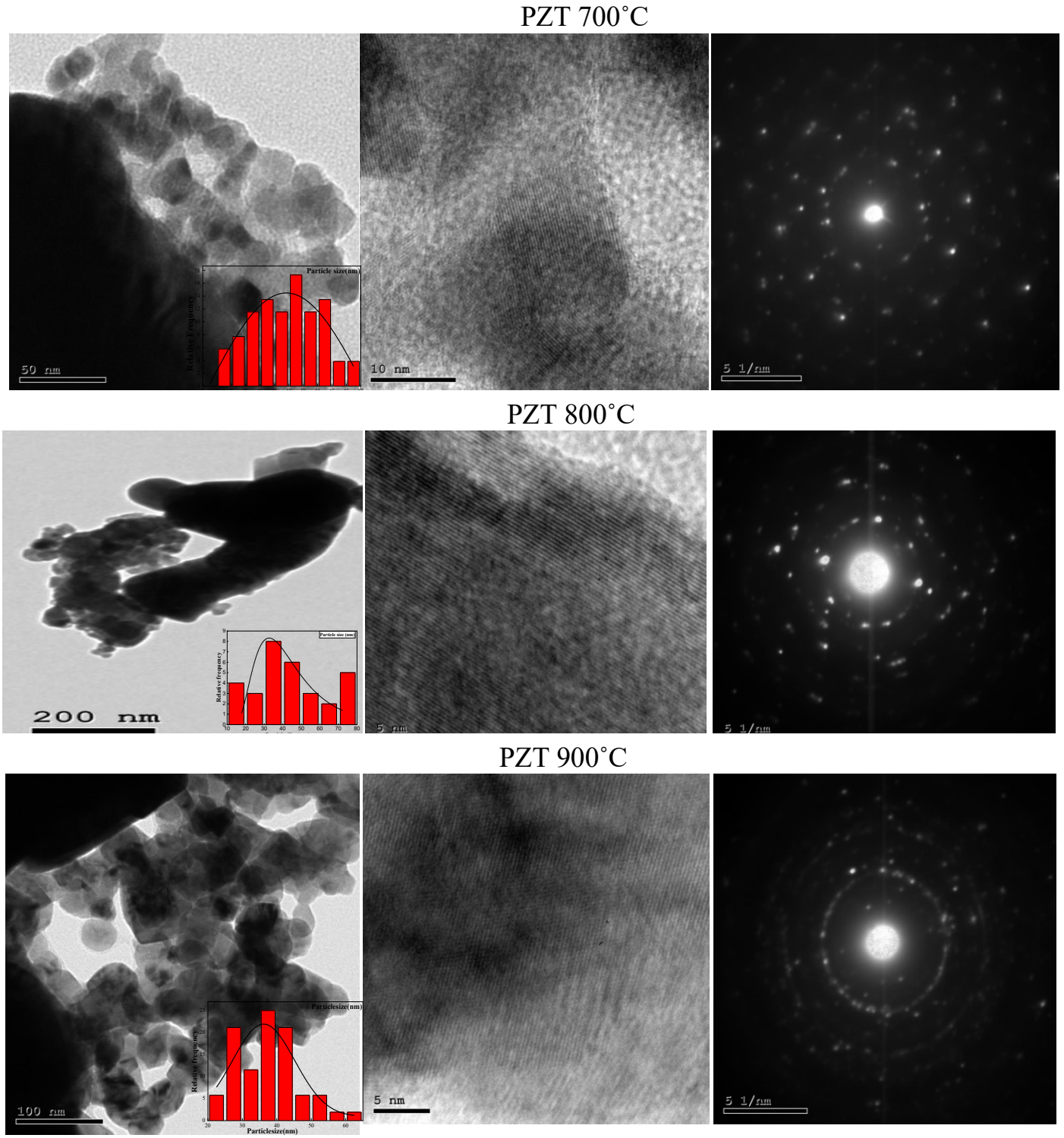

Figure 1. HR-TEM images with corresponding SAED patterns including particle size histograms of the synthesized PZT nanoparticles, calcined in air for 3 h at 700, 800 and 900 °C.