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Dielectric, ferroelectric, and piezoelectric study of lead-free Nanoceramic: $SrBi_4Ti_{4-x}Zr_xO_{15}$ (x = 0.00, 0.025 and 0.05)

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The processing conditions, microstructure, and ferroelectric properties of Nanoceramic Strontium Bismuth Titanate doped with Zirconium are systematically studied. Ferroelectric $SrBi_4Ti_4O_{15}$ is given great attention due to the potential application in Ferroelectric random access memories, piezoelectric sensors, transducers and actuators. Substitutions in the perovskite-like slabs and in the $(Bi_2O_2)^{2-}$ layers of $SrBi_4Ti_4O_{15}$ have been done to study the effects on the ferroelectric properties. In the present study, Polycrystalline Nanoceramics of $SrBi_4Ti_{4-x}Zr_xO_{15}$ (SBTZ-x, x = 0.00, 0.025 and 0.05) were prepared using sol-gel technique of high purity powder mixture of constituent oxides. The specimen is calcined at 800^{0}C for 2 hrs. SBTZ-x was characterized by x-ray diffraction (XRD) and scanning electron microscopy (SEM). X-ray diffraction (XRD) analysis shows the formation of single-phase compound with an orthorhombic structure at room temperature. The (h k l) values are found to agree with standard XRD. Microstructural study by scanning electron microscopy (SEM) suggests that the compound has nano grains distributed uniformly on the surface of the sample. Polyvinyl alcohol is added to powder to bind the particles and to reduce the friction between die-wall and sample surface. Pellets having a diameter of 12mm and thickness of 1 mm are prepared for electrical measurements. The samples are finally sintered at 1170-1200^{0}C. The dielectric, ferroelectric, and piezoelectric studies on SBTZ-x were investigated in the frequency range 1kHz–1MHz from room temperature (RT) to 600^{0}C. Ferroelectric properties are measured for the samples with 90% density compared with XRD density. Polarizations vs. electric field studies at room temperature are done using a PE loop tracer. The remnant polarization and coercive field have increased with increasing the concentration of Zirconium. The dielectric constant was increased and Curie temperature was decreased with increasing the concentration of Zirconium. Piezoelectric charge and electromechanical coupling coefficients were calculated from resonance and anti-resonance frequencies. These materials can be utilized in high temperature applications as substitutes for lead titanate and lead zirconate titanate (PZT)-based ceramics.

Biography

P. Sarah holds a Ph.D in Physics from Osmania University. She is presently Professor and the Dean of Research and Development at Vardhaman College of Engineering, a premier Engineering college in the state of Andhra Pradesh, India.. She has published more than 40 papers in reputed journals and is reviewer of International journals of repute. She has authored a book titled Laser and Optical fibre communications.

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Laser shot peening on Aluminum alloys and Austenitic stainless steel alloys using low energy laser

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This paper presents an alternative method of laser peening process using low energy Nd: YAG laser. The experimental study on Aluminum and Austenitic stainless steel confirmed the feasibility of using low energy pulsed YAG laser for laser peening operation. We have employed different experimental conditions for this study such as laser peening with sacrificial coating on the target surface , without sacrificial coating, different pulse density and laser repetition rate. In all the cases the peened samples were first characterized for surface residual stress measurement using XRD based $\sin^2\psi$ method. The work hardening is evaluated from micro hardness and X-ray peak broadening analysis. Surface morphological changes have been analyzed from surface roughness and AFM.Potentiodynamic polarization studies have been conducted to evaluate the corrosion behavior of the laser peened surfaces.

Biography

S.Kalainathan has completed his Ph.D in 1992 from Crystal Growth Centre, Anna University, Chennai. He got many awards like best researcher, best teacher and National award for crystal growth. He has published more than 90 papers in reputed journals and 170 papers in the conferences. He has completed 4 funded Government projects and ongoing projects 2.10 Ph.D students are completed under his guidance and 7 students are doing currently. He has visited Japan and USA.

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