National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Investigation of Structural Phase Transitions in K0.5Na0.5NbO3 Based Ferroelectric Systems due to Chemical Modifications
Speaker	: Satyaranjan Sahoo (Rollno : 516ph1011)
Supervisor	: Prof. Dillip Kumar Pradhan
Venue	: Venue: MC-212, Committee Room, Department of Physics, Hybrid Mode Join via link: https://us05web.zoom.us/j/81913606416?pwd=TjSJ6zAlvlfkkEa52q067IZ10f6fmu.1
Date and Time	: 13 Dec 2024 (02:15 PM)
Abstract	: Perovskite-based lead-free ferroelectric ceramic oxides are widely used in multifunctional devices such as random-access memory, sensors, actuators, high energy density capacitors etc. Among the different lead-free ferroelectrics, $(K_{0.5}Na_{0.5})NbO_3$ (KNN) based systemhas received significant attention due to its high Curie temperature (T_C ~ 420 °C) and high remanent polarization (P_r = 33 &muC/cm^2). However, KNN-based ceramics have some inherent problems such as synthesis of proper stoichiometric KNN with high density, moderate piezoelectric property, higher coercive field, and poor electromechanical coefficient. To enhance its density, microstructure, and functional properties of KNN, we have adopted chemical modifications at A and/or B sites and the fabrication of solid solutions with different perovskites. In the present work, we have synthesized and characterized (i) solid solution of (1&ndash$x$)$(K_{0.5}Na_{0.5})NbO_3$-$x(Ba_{0.5}Sr_{0.5})TiO_3$, and (1-x)$K_{0.5}Na_{0.5}NbO_3$-xCaTiO$_3$ systems, and (ii) Sm-substituted KNN$((K_{0.5}Na_{0.5})_{1-3x}Sm_x)NbO_3$, and Li/Ta-substituted KNN $(K_{0.48}Na_{0.48}Li_{0.04})(Nb_{1-x}Ta_x)O_3$ systems. All the proposed four series of samples were prepared using solid-state reaction technique. A systematic investigation on the structural, microstructural, temperature-dependent dielectric, ferroelectric, and piezoelectric properties have been carried out over a wide range of experimental conditions. Emphasis has been given to understand the compositional driven structural phase transitions from the XRD and Raman spectroscopic analysis.The structural properties and phase transition behaviors have been correlated with the physical properties. Finally, the phase diagrams over a wide range of compositions and temperatures are presented. The details of our results will be discussed in the seminar.