PONDICHERRY UNIVERSITY

School of Physical, Chemical & Applied Sciences
Department of Physics

Invited Lecture

On

Piezoelectric Ceramics: Concepts, Concerns and Applications

By

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Date : 22.08.2014
Time : **3.30 p.m to 4.30 p.m.**
Venue : Raman Seminar Hall, Department of Physics
Pondicherry University
Puducherry – 605014

ALL ARE WELCOME

Dr. K.V.P. Lata
(Guest lecture Co-ordinator)

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(H.O.D Physics)

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Piezoelectric Ceramics: Concepts, Concerns and Applications

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PZT is one of the most widely studied and exploited piezoelectric material, and has found a permanent place in the field of Materials Science and Engineering. It is widely used in vibration energy harvester/micro-power generator (MPG), resonator/filter, actuators, transducers, FRAM, high-temperature multilayer capacitors in automotive and aerospace related industrial applications and as hydrophones for underwater signals. Most importantly it has an estimated market of tens of billions of dollars for both strategic and commercial applications. However, lead oxide, which is a major component in PZT, is highly toxic and its toxicity is further enhanced during processing at high temperature causing environmental pollution. For a safer environment and human life minimizing or eliminating lead appears to be only option. Consequently, there has been growing interest in developing alternative lead-free ferroelectric and piezoelectric materials which could eventually replace the current lead-heavy ceramics. There had been many attempts by researchers in the past to develop alternative lead-free materials but none of them seems to satisfy the entire criterion required as alternatives to PZT's. Alkali niobates are considered to be promising candidate due to high Curie temperatures (> 400°C) and promising ferroelectric and piezoelectric properties. Our group has been active in developing lead free materials of interest for over a decade. The materials of choice have been Strontium-Barium Niobates (SBN), Barium Titanates (BT), KNN and LNN with emphasis on achieving high density, lowering T_c through composition homogeneity and nanosizing, controlling microstructure and morphology by engineering the materials and enhance dielectric constant, saturation polarization, strain, coupling coefficients, piezoelectric coefficients both low and high temperature to open new vistas of applications.

In this talk, we will review our activities and report correlation between density, microstructure, leakage current ferroelectric and piezoelectric properties of KNN and LNN as a function of sintering temperature for powders synthesized by colloidal coating and Sol-Gel methods followed conventional sintering. Electrical conductivity, Ferroelectric loops, dielectric constant, strain has been measured and compared with PZT. Challenges in achieving or matching all the parameters with PZT will be also be discussed for both KNN and LNN lead free ceramics.