Executive Summary Report of the Minor Research Project

PREPARATION AND CHARACTERIZATION OF STRONTIUM BARIUM NIOBATE NANO CERAMIC SYSTEMS

Submitted to the

University Grants Commission

(UGC Ref. No.**1785-MRP/14-15/KLMG002/UGC-SWRO dtd 04-02- 2015**)

by

Dr. P NUJA S JOHN
DEPARTMENT OF PHYSICS
CMS COLLEGE, KOTTAYAM
KERALA– 686 001, INDIA

MARCH 2017

EXECUTIVE SUMMARY OF MINOR RESEARCH PROJECT

(UGC Ref. No.**1785-MRP/14-15/KLMG002/UGC-SWRO dated 4-02- 2015**)

The project work aims at the preparation and characterization of selected nanosized materials. Strontium Barium Niobate (SBN) and Rare Earth (Sm^{3+}, Eu^{3+} and Ce^{3+}) doped SBN were selected as the materials for the study. Cerium doped SBN ceramic powder was synthesized in nano range using sol-gel method.

Cerium doped SBN nanosized ceramic system was characterized by XRD, TG/DTA, FTIR, and Raman spectra. XRD confirms the desired phase of tungsten bronze in the prepared SBN system based on JCPDS Card No: 39-0265. The absorption peaks in FTIR are associated with Sr-O, Ba-O and Nb-O. Particle morphology of the system has been examined using SEM. The SEM image reveals the rod like structure of grains with diameters in the range 1.2 to 1.5 μm. The nano crystallite size was confirmed from HRTEM images. The average particle size estimated from the TEM micrograph is in the range of 40 nm. Incorporation of Ce^{3+} in SBN host was confirmed by the Energy Dispersive X-ray studies. The absorption in the sample is from a direct transition and the value of energy gap calculated for Cerium doped SBN nano ceramic system is 3.2 eV. Emission spectrum shows broad emission band extending in blue region from 406 nm with the maximum intensity at 416 and 440 nm due to 5d - 4f transition. The measured luminescence decay of cerium doped nano system is tri exponential. These investigations clearly demonstrate that the Ce^{3+} ion is a promising activator in SBN nanosized ceramic system for optical applications such as displays, FET and sensors.

The frequency dependent measurements with dielectric constant of pure and rare earth doped SBN nano systems were measured. It is observed that pure SBN and cerium, samarium doped SBN nanosized systems have high dielectric constant at low frequency. The variations of ME voltage with AC and DC magnetic field were studied for pure SBN, rare earth [Europium, cerium] doped SBN nano ceramic systems. The highest value of the magneto electric coefficient (α) is observed for pure SBN. The coupling coefficient (α= 15 $\mu V/cm^{-1}/Oe^{-1}$) is determined from the slope of graph. The high value of ME coefficient indicates the coexistence of electric and magnetic phases in the SBN nano system. Therefore the above studies confirm the optical, electric and magnetic properties of SBN nano ceramic systems.