EXECUTIVE SUMMARY OF MINOR RESEARCH PROJECT

Name of the Principal Investigator	**Dr.Narayana Moolya.B**
Title of research project	**Studies on Optical and Electrical properties of doped non linear optical L-Arginine Phosphate (LAP) NLO single crystals**
UGC Reference No.	**MRP(S)-0116/12-13/KAMA002/UGC-SWRO dated 29-03-2013**

Present research project was aimed at growth, characterization and a study of Optical and Electrical properties of doped semiorganic NLO materials of L-arginine phosphate (LAP) family. 'Semiorganics' are the materials in which the typically high optical nonlinearity of a purely organic ion is combined with the favourable mechanical and thermal properties of an inorganic counter ion. The underlying motivation for this approach is to combine the high optical nonlinearity associated with organic molecules with the favourable mechanical and thermal properties of inorganic crystals. Crystals of pure LAP and IDAA doped LAP have been carried out in the present study. The following general conclusions could be drawn from the set of observations and the analysis carried out during investigation.

Low Temperature Solution Growth Technique has proved to be a successful technique to grow crystals studied in the present investigation. Many researchers have reported the growth of nonlinear LAP, one of the stable NLO single crystals. In the present investigation, the grown crystals are nonhygroscopic in nature, stable at room temperature and show good second harmonic generation. Here the main task was to obtain supersaturation. High level of supersaturation with pH in the range 4-5 yields good crystals. There should not be any mechanical disturbance, otherwise agglomeration results.. But main limitation of this growth technique is the incorporation of solvent in the crystal which limits the transparency. Also, surface imperfections develop when the crystals grow to larger dimensions.

Materials required for the growth of single crystals in the present investigation were synthesized in the laboratory starting from L-arginine. Various solid state characterization techniques have been employed to confirm their identity, purity and crystallinity. Functional groups in the synthesized materials were identified by the spectroscopic methods such as FT-IR. Most of the expected bands have appeared in the spectra of the compounds.Powder X-ray diffraction pattern of the compounds was recorded and indexed. These patterns proved the crystallinity of the synthesized materials.

UV-vis–NIR absorption spectral studies of Pure LAP and IDAA doped crystals were conducted. From these studies, the optical absorption edge and the bandgap energy have been calculated.

Pure LAP and IDAA doped crystals have a cu-off wavelength of 220 and 230 nm respectively. These values are comparable to that of the standard NLO crystal KDP (176nm). Second harmonic conversion efficiencies of Pure LAP and IDAA doped crystals were determined and compared with that of KDP.

V-I characteristics of Pure LAP and IDAA doped crystals at various temperatures were recorded in crystalline form by applying a voltage up to 110V. From these measurements, the dc conductivity and the activation energies of the samples were calculated at different applied voltages. These calculations reveal that the activation energy remains almost constant with applied voltage. Various conduction mechanisms that might exist in the sample were investigated. From the dc response, it is clear that the conduction mechanism in these samples is mainly Richardson-Schottky type i.e. electron emission from the cathode. This current is enhanced by Poole-Frenkel mechanism i.e., lowering of the electric field by reducing the barrier height. There is no tunneling current in these crystals.

Variation of dielectric constant, dielectric loss and ac conductivity of the samples with frequency and temperature was studied. Dielectric constant; dielectric loss and ac conductance show a strong dependence on frequency and temperature as done by most of the ionic crystals. The increase in conductivity at higher temperature can be attributed to formation of additional defects, lowering of barrier height due to electric field and decrease in density due to thermal expansion. Abrupt variations of any sort in dielectric constant or ac conductivity were not noticed in any of the samples studied, which rules out the possibility of phase transitions of any kind. The pattern of variations in dc and ac conductivity, dielectric constant and dielectric loss remains same in the hydrogen halides of both Pure LAP and IDAA doped LAP crystals.