UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG

NEW DELHI – 110 002

EXECUTIVE SUMMARY OF THE REPORT

1. Name of Principal Investigator : Dr. V. Vasudevan

2. Department of PI : Physics

Name of College : K.S.Rangasamy College of Technology
Tiruchengode, Namakkal Dist – 637 215

3. UGC approval Letter No. and Date : F.No: MRP-6106/15 (SERO/UGC) dated January, 2015

4. Title of the Research Project : Effect of Metal ions on Physical and Chemical Properties of Unidirectionally grown Amino acid based Semi-organic Single Crystals

1. Single crystal growth

1.1 Growth of pure LMHC and LAHB single crystals

1.1.1 Slow solvent evaporation (conventional) method

Good quality LMHC and LAHB single crystals were grown using the water solvent at room temperature. The maximum size of LMHC and LAHB single crystal grown by this method is 60 x 45 x 7 mm^3 and 47 x 42 x 8 mm^3, respectively.

1.1.2 Unidirectional solution growth method

Growth along a particular direction is known as unidirectional growth. Anyone plane of the conventional grown crystal is chosen as seed crystal for unidirectional growth. The LMHC single crystals were grown unidirectionally along (100) and (001) orientations and the LAHB single crystals were grown unidirectionally along (001) direction.

2. Growth of doped LMHC and LAHB single crystals

LMHC were doped with Cu^{2+} and glycine in 1:0.05 molar ratio. The doped crystals were grown by conventional and unidirectional solution growth methods. The doped crystals were confirmed by single crystal X-ray diffraction studies. The (001) plane was chosen for

unidirectional growth for both Cu^{2+} and glycine doped LAHC single crystals. On the other hand, Zn^{2+}, Fe^{2+} and Fe^{3+} metal ions were chosen as dopants for LAHB single crystals. The (001), (100) and (010) planes of LAHB crystal were chosen for unidirectional growth of doped LAHB single crystals.

3. Comparison of pure and doped LMHC single crystal

Various characterization studies were performed to compare the physical properties of pure and Cu^{2+} and glycine doped LMHC single crystals. High-resolution X-ray diffraction showed that the doped crystals have low full width half maximum for the main peak and have good crystalline perfection when compared to that of pure LMHC crystal. Due to the decreased FWHM, the UV-visible transparency and mechanical stability were increased for doped crystals. The dielectric constant, refractive index and second harmonic generation efficiency were also high for doped crystals. Hence, the physical properties of LMHC single crystal were enhanced by the process of doping.

4. Comparison of conventional and unidirectional LMHC single crystals

The (001) plane of conventionally and unidirectionally grown LMHC single crystals was chosen for the comparison of physical properties. It was noted that the crystalline perfection, optical homogeneity, optical transparency, mechanical stability was better for unidirectionally grown LMHC when compared to that of conventionally grown LMHC. From dielectric studies, piezoelectric resonance frequencies were obtained for both conventionally and unidirectionally grown LMHC single crystals in the kHz frequency range. The piezoelectric resonance frequencies were found to be dependent on the sample dimension.

5. Unidirectionally grown doped LMHC and LAHB single crystal

Bulk LMHC and LAHB doped single crystals were grown by unidirectional solution growth method along different orientations. The crystalline perfection of doped unidirectional LAHB crystal was analyzed by high-resolution X-ray diffraction study for (004) plane. The FWHM of the main peak is 30 arc s which shows the crystal is reasonably good. The optical transparency of 1 mm thick doped LAHB crystal is 75 % in UV-visible region and the cutoff wavelength is at 224 nm. The electro-optic parameters like refractive index and birefringence was increased by doping of LAHB single crystals. LMHC single crystals were also doped with metal ions in order

to improve the electro-opic properties. From the results it was observed that the Birefringence and dielectric properties have been tuned for unidirectionally grown doped crystals.

SIGNATURE OF PRINCIPAL INVESTIGATOR

PRINCIPAL