ABSTRACT

The fascinating field of nonlinear optics (NLO) has a direct bearing on technology and has brought about enormous changes in the fields of Science and Engineering. In today’s context of demand for real time control and communication, NLO materials play a vital role in the fabrication of electro-optic modulators, which convert an electric signal to an optical one for transmission through a fiber optic cable. The application of NLO materials includes fiber optics, image applications using photo refractive crystals, frequency multipliers and mixers, parametric oscillators and optical switches. Because of the effectiveness in generating new frequencies from existing lasers via harmonic generation and sum and difference frequency generation, there has been a wide search in recent years to identify suitable materials for such processes. It is expected that these materials should (i) be resistant to optical damage, (ii) have high mechanical hardness, (iii) exhibit good thermal and chemical stability, (iv) be capable of being grown in useful size and (v) have the appropriate phase-matching properties.

In the present study we have grown cadmium mercury thiocyanate crystals by solvent evaporation solution method. The entry of all the three metal ions (Cd$^{2+}$, Hg$^{2+}$ and Zn$^{2+}$) into the crystal lattice was confirmed by EDAX.

X-ray diffraction data were collected from powder samples of crystals using an automated X-ray diffractometer. The reflections were indexed and lattice parameters, unit cell volume were calculated.
The FT-IR spectra of all the grown crystals have been recorded in the wave number range 400-4000 cm\(^{-1}\) to identify the occurrence of different functional groups. The peak at 2100 cm\(^{-1}\) confirms the presence of SCN group in the grown crystals.

The thermograms of the grown crystals were recorded in the temperature range 300\(^0\)C - 1000\(^0\)C. It is observed that two decompositions stages have been noted in the temperature range considered with the first decomposition taking place in the temperature range 310\(^0\)C - 520\(^0\)C and the second decomposition in the temperature range 520\(^0\)C - 1000\(^0\)C.

The dielectric spectral analysis of all grown crystals were recorded and determined the variation of dielectric constants with frequency. The crystals were powdered and sandwiched between glass plates and exposed under Nd:YAG laser to test the NLO property. From the calculated datas the grown trimetallic thiocyanate crystals have very good non linear optical properties.