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Raman Spectroscopy Of Ferrous, Barium And Ammonium Chloride Doped ZTS Crystals

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Abstract: ***Zinc tris (thiourea) Sulphate (ZTS) is important semi organic non linear optical crystal with molecular formula as $Zn(NH_2CSNH_2)_3SO_4$. Ferrous chloride doped, barium chloride doped and ammonium chloride doped ZTS crystals were grown by single diffusion gel growth technique at the ambient temperature. The Raman spectroscopy of three chloride doped ZTS crystals was analyzed and functional groups from the wave numbers were evaluated.***

Keywords: ZTS crystals, Raman Spectroscopy, Functional groups

I. INTRODUCTION

ZTS possesses low angular sensitivity therefore it is proven as type II second harmonic generation. It has high damage threshold makes it better alternative of KDP crystals. ZTS crystal possesses a low UV- cutoff as about 260nm, wide range of transparency and low dielectric at high frequencies[1-4]. Raman spectroscopy is an optical technique which is commonly used to provide a structural fingerprint by which molecules can be identified. It is a non-destructive chemical analysis technique. It is based upon the interaction of light with the chemical bonds within the materials. Raman spectroscopy is a light scattering technique, whereby a molecules scatters incident light from a high intensity laser light source. Small amount of the scattered light is at the different wavelength except from the Rayleigh scatter which depend on the chemical structure of the crystals.

II. EXPERIMENTATION

Laser Raman Spectra of chloride doped ferrous, barium and ammonium ZTS crystals were analyzed with Renishaw InVia Reflex Raman Microscope. Laser grating was 537nm laser with 2400 line/mm and exposure time was 1sec. The Raman Spectrum for ferrous chloride doped ZTS crystals, barium chloride doped ZTS crystals and ammonium chloride doped ZTS crystals were shown in figure 1, 2 and 3 respectively. Sharp peaks of spectra shows stoke and antistokes wave numbers of Raman Shift. Each molecule has its own characteristic spectrum. It provides fingerprint of a substance from which molecular composition can be determined. Furthermore, the intensity of a band is proportional to the concentration of the molecules from which the band arises[5].

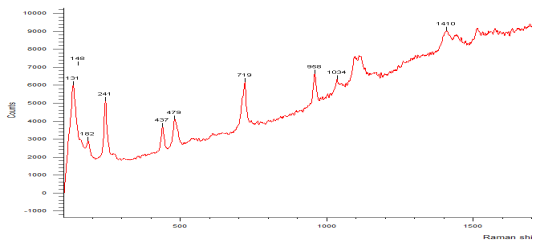

Figure 1: Raman Shift of Ferrous chloride doped ZTS crystals

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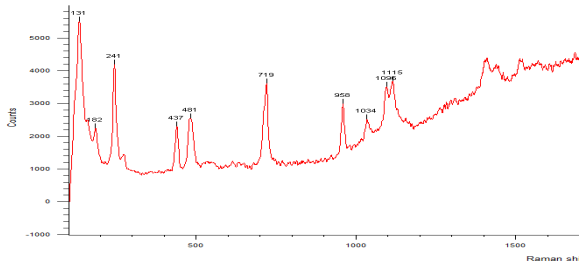

Figure 2: Raman Shift of Barium chloride doped ZTS crystals

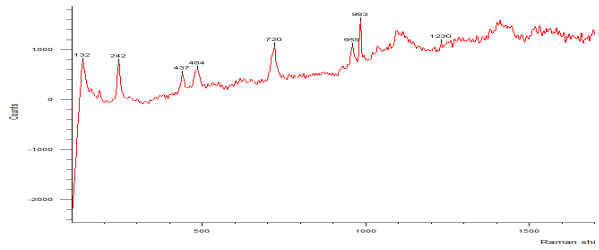

Figure 3: Raman Shift of Ammonium chloride doped ZTS crystals

III. RESULTS

The Raman Shift in wave number and corresponding presence of functional groups in chloride doped ferrous, barium and ammonium ZTS crystals are shown in Table 1. Here, author compared the chloride doped ZTS crystals with the pure ZTS crystals[6].

Wave numbers cm^{-1}				Functional Group
Pure ZTS[6]	Ferrous chloride doped ZTS	Barium chloride doped ZTS	Ammonium chloride doped ZTS	
182	-	182.442	182.311	Lattice vibration
241	241.233	241.296	242.156	Lattice vibration
434	437.284	437.455	436.608	Symmetric stretching of C-N
478	478.608	481.365	484.129	Symmetric stretching of C-N
716	718.91	718.806	719.667	Zn-S vibrations
957	957.575	958.441	959.2	C-H bending
1112	~1100	1114.82	~1100	C-O Stretch

Table 1: Raman shift and related assignment of pure and chloride doped ZTS crystals

IV. CONCLUSION

Here, from chloride doped ZTS crystals, the intensity are slightly increased. Moderate intensity was observed in the barium chloride doped ZTS crystals. The vibrational bend at $716cm^{-1}$ attribute to Zn-S vibrations of pure ZTS crystals are similar as shown in ferrous chloride doped, barium chloride doped and ammonium chloride doped ZTS crystals as 718.91 cm^{-1}, 718.806 cm^{-1} and 719.667 cm^{-1} respectively. The respective stretching of C-O at 1112 cm^{-1} in pure ZTS spectrum were 1100 cm^{-1} , 1114.82 cm^{-1} and 1110 cm^{-1} in ferrous, barium and ammonium chloride doped ZTS crystals respectively.

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