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Comparative surface etching study of pure and glycine doped potassium thiourea chloride crystal

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Abstract:

In present investigation the surface analysis has been performed by means of etching studies. The etch patterns developed on surface of pure and glycine doped potassium thiourea chloride (PTC) crystal has been examined to study the growth habit and structural defects associated with pure and glycine doped PTC crystal. The etch micrographs were recorded at a scale of 5 µm after the interval of 40 s.

Keywords: Etching studies, Surface analysis

1. Introduction:

Extensive research has been done on nonlinear optical (NLO) metal complex crystals which rapidly enforced the development of thiourea metal complex (TMC) crystals for photonics, laser frequency conversion, signal modeling and optoelectronics device applications [1-2]. The known TMC crystals are zinc thiourea sulphate (ZTS), bis thiourea cadmium chloride

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(BTCC), copper thiourea chloride (CTC), zinc thiourea chloride (ZTC), bis thiourea cadmium acetate (BTCA), bis thiourea zinc acetate (BTZA) and potassium thiourea chloride (PTC) have been reported [3-4]. The doping of additive shows key role in enhancing the quality of host material. Current investigations also showed that the doping of selected impurities in TMC crystal has significant impact on various qualities of TMC crystals. The amino acid glycine has potential ability to enhance the charge mobility and photochemical stability of TMC crystal. The doping of glycine has an assertive impact on features of BTCF, BTCC, ZTS, ZTC and BTCA crystals [5-9]. The potassium thiourea chloride (PTC) crystal is a promising NLO material [4]. It is worthy to notify that no doping attempt was made in PTC crystal till date. In this paper we firstly reports the surface analysis of glycine doped PTC crystal by means of etching studies.

2. Experimental

The PTC material was prepared by dissolving thiourea (1mole%) and potassium chloride (4mole%) in de-ionized water. The recrystallization process was employed to achieve purity of PTC complex. The supersaturated solution of PTC complex was obtained and glycine (3mole%) was gradually added to the solution. The glycine added PTC solution was allowed to stir for eight hours for homogeneous doping of glycine in PTC. The G-PTC solution was filtered in rinsed beaker and kept for slow solution evaporation in an isothermal medium. The fully grown single crystals were harvested for etching studies.

3. Results and discussion:

3.1. Etching studies

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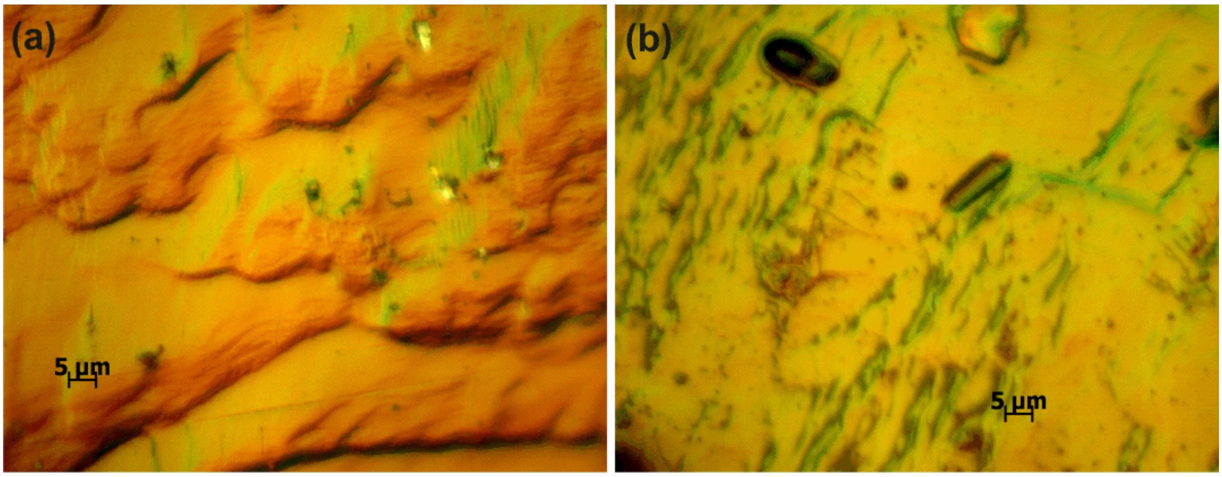

Fig. 1. Etch pattern of pure and glycine doped PTC crystal after 40 s

The etching study gives the idea of surface purity, growth habit and structural defects associated with crystal. For present analysis the plane face of pure and G-PTC crystals was selected and etched with water for a period of 40 s. The resulted micrograph after an interval of 40 s was recorded. The etch patterns of PTC and G-PTC crystal are shown in Fig. 1a and 1b respectively. Analysis of Fig. 1a reveals that the PTC crystal to has a step growth habit throughout the surface. In Fig. 1b the G-PTC crystal shows plane surface with few irregularly shaped defects which might have appeared due to solvent vacuoles in crystal. The largely occupied plane surface of G-PTC crystal defines its high purity as compared to PTC crystal.

3. Conclusion:

The surface analysis of pure and glycine doped PTC crystal has been accomplished by means of etching studies. The recorded micrographs confirmed the step growth habit in PTC crystal while the plane surface was observed in G-PTC crystal. The absence of large micro-pits and step growth habit in G-PTC crystal indicates its good crystalline nature with minimum defect centres. This confirms that glycine is potential material to tune the surface properties of PTC crystal.

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