



Growth Kinetics and Thermo-Opto-Electrical Properties of Cobalt Reinforced Zinc phosphate Crystals

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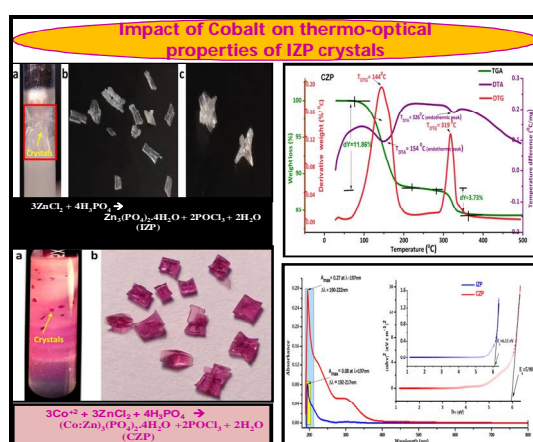
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ABSTRACT

Cobalt doped zinc phosphate (CZP) and intrinsic zinc phosphate (IZP) crystals were grown by gel diffusion reaction technique. In the optimized growth environment with suitable Co^{2+} doping, pink coloured, hard, transparent CZP crystals were developed from the parent IZP crystals. Energy dispersive X-ray analysis (EDAX) identified Co^{2+} , Zn^{2+} and PO_4^{3-} ions complex in doped CZP crystals. FTIR spectral studies confirmed phosphate group, water molecule and M-O bond; which form armature of IZP and CZP crystals. Thermo gravimetric analysis (TGA) identified crystalline water, co-ordinated water and stability of the crystals in anhydrous phosphate phase above 500°C . P-XRD measurements depict high crystallinity of CZP and IZP crystals. IZP crystal propounded with a chemical formula $\text{Zn}_3(\text{PO}_4)_2(\text{H}_2\text{O})_2 \cdot 2\text{H}_2\text{O}$ (molecular weight = 458.174) and CZP crystal manifested with a chemical formula of $(\text{Co}_{0.1228} \text{Zn}_{0.8772})_3(\text{PO}_4)_2 \cdot \text{H}_2\text{O} \cdot 3\text{H}_2\text{O}$ (molecular weight=455.795) respectively. Optical studies unveiled insulating behaviour of parent and doped crystals. Co^{2+} cationic incorporation to Zn^{2+} vacancies increased the electrical conductivity. IZP and CZP possess dielectric constants of 18.32 and 17.53 in order. Investigation on growth aspects and thermo-opto-electrical properties merely highlighted the distinctness of CZP and IZP crystals.

Graphical Abstract



Keywords: Conductivity, Dielectric, Insulator, Silica gel, Thermal.