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Research Paper

Growth, Optical, Mechanical, Thermal and Dielectric Properties of Nonlinear Optical Single Crystal: Magnesium Iodate

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The good optical quality monometallic single crystals of Magnesium iodate [$Mg(IO_3)_2$] were grown from aqueous solution by slow evaporation technique at room temperature with dimension upto 7 x 6 x 3 mm^3 in the period of 25-30 days. Single crystal XRD analysis shows that magnesium iodate crystallizes in monoclinic system with space group $P2_1$. The spectroscopic properties were characterized by FTIR and optical absorption spectra. Optical band gap is calculated as 3.96 eV. SHG efficiency is found to be around 4 times than that of potassium dihydrogen (KDP) crystal. The microhardness test conducted on the crystal suggests that the crystal has a relatively high mechanical strength. TGA curve depict that the compound is thermally very stable up to 650 °C. The dielectric constant and dielectric loss of the compound were measured at different frequencies with varying temperature.

Key Words: Solution Growth; Monometallic; Nonlinear Optical; Microhardness; TGA; Dielectric Constant

1. Introduction

Second order nonlinear optical (NLO) materials with short transparency cut off wavelength and stable physicochemical performances are needed in order to realize many of the applications like telecommunications, optical computing, optical information processing, optical disk data storage, laser remote sensing, laser-driven fusion, color displays and medical diagnostics [1-4]. Hence, considerable interest is given by the researchers in the synthesis of new materials which has excellent second order optical nonlinearities.

Though organic NLO crystals have high nonlinearities, fast response and tailor-made flexibility, their applications were limited because of their shortcomings such as poor physicochemical stability, poor phase matching, red shift of the cut-off wavelength, etc. These problems have been solved by metal coordination ligands such as thiourea, thiocynate and iodate. Some of the complex crystals like BTCF, ZTS, CMTC, MMTC, ZCTC, $Hg(IO_3)_2$, $Cd(IO_3)_2$, $Mn(IO_3)_2$ [5-9] which possess the high nonlinearities as well as stable physicochemical properties. In this view, we have initiated to work on iodate complex crystals.

Present study forms part of investigation on the iodate crystals. Metal iodates have been extensively studied for their nonlinear optical property due to the presence of a lone pair on iodine in the iodate group favours the acentric structure formation with remarkable thermal stability [10]. Thus, Bergman et al in 1969 [10] has been reported that the halate ions

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