15-Crystal Growth

PS-15.02.09 CRYSTAL GROWTH AND DEFECT OBSERVATION OF β-BaB_2O_4 AND LiB_3O_5 SINGLE CRYSTALS. By J.K. Kang, C.H. Kim, B.M. Lim, and S.J. Chung*, Department of Inorganic Materials Engineering, Seoul National University, Seoul 151-742, Korea.

Single crystals of β-BaB_2O_4 (BBO) and LiB_3O_5 (LBO) have been grown by top-seeded solution growth using fluxes of Na_2O and B_2O_3, respectively. (Chen, C.T., J. Crystal Growth, 1990, 99, 790-798) These flux systems cause many problems on crystal growth, such as a high solution viscosity, low growth rate, and a high defect concentration. So, these fluxes were modified by adding fluorides. BBO crystals up to 75x75x15mm^3 in size could be grown at a cooling rate of 2~10℃/day, seed rotation rate of 2~10 rpm, and pulling rate of 0.2~1mm/day, and LBO crystals 20x20x10mm^3 in size, at 1~3℃/day, 5~20 rpm, and 0.1~0.3 mm/day.

During the crystal growth, inclusions such as bubbles and fluxes were usually concentrated around the seed crystal, and the cellular structure was generated at a high growth rate. Thermal strain and thermal shock caused the development of dislocation bundles and cracks in the growing crystals. These grown-in defects were investigated by X-ray topography, optical microscopy and electron microscopy. We have studied the change in morphology according to flux modification and the relationships between the generation of defects and growth conditions.

PS-15.02.10 GROWTH, CHARACTERIZATION AND PROPERTIES OF MIXED Nd-La HEPTAMOLYBDATE CRYSTALS. By Sushma Bhat and P.N.Kotru, Department of Physics, Jammu University, J&K, INDIA, M.L.Koul, Department of Chemistry, Jammu University, J&K, INDIA, R.P.Tandon, NPL, New Delhi, INDIA.

Growth of single crystals of mixed Nd-La heptamolybdates in silica gels is achieved using single gel as well as double gel techniques. Seeded growth and concentration programming enhances the ultimate size of crystals. Data on the characterization of these crystals employing XRD, TEM and IR (structural characterization), EDAX (chemical characterization) and optical and scanning electron microscopy (morphological characterization) are reported and discussed. The thermal stability of the crystals is investigated employing TG, DTA and DSC. It is estimated that the crystals carry 35 waters of hydration which renders them thermally unstable at slightly above room temperatures (>40 C). The study shows that there are no phase transitions as such. Solid state reaction kinetics are studied using Piloyan-Novikova, Coats-Redfern and Horowitz-Metzger and Barret's equations. The data yielding the values of frequency factor, activation energy, and order of reaction are presented. Pallets of 2.5 mm thickness and 7.2mm diameter are used for dielectric measurements employing LF 4192 Impedance Analyser. Dependance of Dielectric constant and loss (tan) on temperature and frequency is investigated. The dielectric constant increases as the temperature is increased, attains the maximum value and then decreases steadily; the maximum value of depends on the frequency. The detailed data is presented and discussed.

PS-15.02.11

THE GROWTH OF Mg:Fe:$LiNbO_3$ CRYSTAL AND THE MEASUREMENTS OF EXPONENTIAL GAIN COEFFICIENT**. By Zhao Yequan* Li Ming hua, Gao Yuankai, and Xu Yuheng, Department of Applied Chemistry, Harbin Institute of Technology, Liu Jinghe, Department of Material Engineering, Changchun Institute of Optical Machinery, P. R. China.

It has been shown that the ability of resistant photorefraction and photorefractive sensibility of $LiNbO_3$ crystals can be enhanced by doping them with MgO and Fe_2O_3. Its two-wave mixing gain (103cm^{-1}) is four times that of $BaTiO_3$ and the response rate of phase-conjugation was increased by an order of magnitude.

The Mg: Fe: $LiNbO_3$ crystals were grown by using Czochraski technique. The components of the melt are Li_2CO_3/Nb_2O_5=48. 6/51. 4 (mole ratio), 5 mole%MgO and 0. 08mole%Fe_2O_3. In order to grow perfect crystals, the optimum growth conditions that we have used are as follows: axial temperature gradient 40℃/cm, growth rate2-3mm/h, rotation rate of the crystal 20—30 rpm. Then, the crystals were polarized so as to become single domain crystals by passing through them 5mA/cm^2 of current density at 1220℃. For multiple memories, the concentration of [Fe^{3+}] should be very larger than that of [Fe^{2+}] so as to reduce erasion during memory, therefore, Mg:Fe:LN should be oxidated in Nb_2O_5 powder at 1000℃ for 10h and reduced in Li_2CO_3 powder at 500℃ for 40h for read-write memory application. Furthermore, we have measured the visible—infrared absorption spectra and OH^- extensive ocsillation transmitting spectra of the crystals. There is a small peak (2cm^{-1}) at 490nm for the oxidated crystal; and a big peak (15cm^{-1}) at 480nm for the reduced crystal; the transmissing spectra present two absorption peaks at 2830nm and 2850nm respectively. And the former is more higher than the latter. Finally, we have also measured the two wave mixing gain, the results is 103cm^{-1}, when β=1049, 2θ=11. 5°.

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PS-15.02.12 REDUCTION OF PHOTOREFRACTIVE $LiNbO_3$ CRYSTALS IN POWDERED Li_2CO_3**. By Li Minghua*, Gao Yuanquan, Zhao Yequan and Xu Yuheng, Department of Applied Chemistry, Harbin Institute of Technology, P.R. China.

Reduction is an effective way to enhance the photorefractive sensitivity of $LiNbO_3$ crystals. One kind of reduction occurs at temperatures higher than 1000° C, in vacuum or in an Ar atmosphere. The reduction mechanism is attributed to oxygen atoms liberated from the host crystal at high temperature. In 1974, W. Phillips and D.L. Staebler found that $LiNbO_3$ packed in powdered Li_2CO_3 at 500°C or so may be reduced more completely. In the present paper, this reduction process is investigated by using absorption spectra and X-ray diffraction. A congruent $LiNbO_3$ crystal was grown by the Czochralski method. Reduction of the crystal

