MS16.03.02 LOW-FREQUENCY VIBRATIONAL CONTROL OF CRYSTAL GROWTH FROM MELT. E.V. Zharkov(1,2), A.Z. Myalkin(3,4), A.I. Prostomolotov(5), N.A. Veezeb(6), (1,2) Mendeleev University of Chemical Technology of Russia; (3) General Physics Institute of Russian Academy of Sciences; (4) Institute for Problems in Mechanics of Russian Academy of Sciences.

Influence of low-frequency (LF) vibrations on growth process and crystal perfection originating from vibrational control of melt flows and heat-transfer at crystal growth excite now rising interest of both crystallographers and hydrodynamics. The practical importance of forced vibrational convection connected with the fact that the introducing flows allow to influence on crystal quality, to control temperature field, thickness of boundary layer and to suppress temperature oscillations in the melt near the interface by the complex interaction with flows of natural and thermocapillary convectons.

Experiments on growth of doped yttrium-scandium-gallium garnet (Tm = 2156 K) by CZ-technique were performed. The high quality of epitaxy processes shows essential positive effect of the LF-vibrations on growth and finally in crystals. The success in efficiently synthesizing fullerenes has been confirmed. Larger undercoolings of the melt were also grown in a furnace. C60 crystals were also grown in a tube, the tube was kept at 70°C. Crystals were grown from a K2Mo3O10-containing flux with applying of LF-vibrations up to a value close to 10400 10–9 m/V and seeks for an orientation of a-crystal axes that optimizes either frequency doubling (SHG) or the electro-optic (EO) effect of macroscopic crystals [1-3].

On account of a low yield [1-3] of crystal structures providing a parallel alignment of dipole (max. EO effect), recent interest focused on the packing of NLO molecules along parallel channels of inclusion type lattices [4]. When compared to other host materials [5], perhydrophencylene (PHTP) worked out to be ideally suited [6,7] to include a variety of linearly shaped NLO entities of the A–π–D type (A, D-acceptor, donor group, respectively; π: thiophene, stilbene, polyphenyl, polyacetylene). SHG powder tests revealed that PHTP (A–π–D) inclusion formation produces polar materials at a yield of around 75% that is 3 times higher than found for corresponding single component systems. Crystals of PHTP (A–π–D) were grown by (i) controlled isothermal evaporation of 2-butanone or paraffin, (ii) the temperature difference technique, and (iii) by sublimation [8].

MS16.03.03 LIQUID PHASE EPITAXY OF HT SUPERCONDUCTORS. P. Gännt, T. Aichele, S. Bormann, C. Dubs, Institut für Physikalische Hochtechnologie e.V., Helmholtzweg 4, PF 100 239, D-07702 Jena, Germany.

YBa2Cu3O7 films were grown on (110) NdGaO3 substrates by liquid phase epitaxy (LPE) using the “step cooling technique”. A transition from c-axis to a-axis orientation could be observed with increasing undercooling for different flux melt compositions. Polyonized macrosteps were revealed optically at c-axis films grown with small undercoolings. Atomic force microscopy (AFM) measurements show that macrosteps are composed of a multitude of smaller growth steps. Besides decorated step structures were found on terraced surfaces between the macrosteps. The high quality of epitaxy has been confirmed by X-ray diffraction measurements showing rocking curve widths (FWHM) of 0.2-0.3° for the [004] reflection. Larger undercoolings of the flux melts result in mixed c/a-axis growth and finally in a-axis growth reported already earlier.

MS16.03.04 GROWTH AND CHARACTERIZATION OF C60 AND C70 CRYSTALS. Kenichi Kojima and Masaru Tachibana, Department of Physics, Faculty of Science, Yokohama City University, 22-2 Seto, Kanazawa-ku, Yokohama 236, Japan.

The success in efficiently synthesizing fullerenes has generated much interest in the physical properties of this new class of molecular crystals. The growth of single crystals with high quality is required for studies on the intrinsic physical properties. In this work, C60 and C70 crystals of large size and high quality were grown from vapor by a continuous pulling technique, and their perfection were examined by X-ray topography and etching method.

C60 crystals of small size were used as the source material, which was deposited onto the closed end of a pyrex tube. The tube was evacuated to 1-3xl06 Torr and then sealed off. The tube was placed in a horizontal furnace with two oppositely oriented temperature gradients, where the temperature of the middle portion of the furnace was kept at 530°C and its opposite sides were at 500°C. The tube was advanced towards the source at a pulling rate of 1 cm/day in the furnace. After 3-4 days, C60 crystals up to a size of about 8x8x3 mm3 were grown at the middle of the furnace. C70 crystals were also grown in the same way as C60. Here it was necessary to use higher temperatures of the furnace since the vapor pressure for C70 is lower than that for C60.

The perfection of the grown C60 crystals with fcc structures were examined by x-ray topography. Some of dislocations were individually observed. Most of their Burgers vectors were identified to be 1/2[1110]. Moreover, dislocation etch pits were observed by immersing the grown C60 crystals into toluene for 5 seconds. From the distribution of the etch pits, the dislocation density in most of the grown crystals was estimated to be less than 104/cm².

To make sure of the characteristics of defects, the mechanical properties, such as hardness and plasticity, of C60 and C70 crystals were investigated using the microindentation technique.

MS16.03.05 CRYSTAL GROWTH AND CHARACTERIZATION OF NLO ACTIVE ORGANIC INCLUSION COMPOUNDS. Jürg Hülliger, Olaf König, Vera Kramer-Hoss, Institute of Inorg., Analyt. and Physical Chemistry, University of Berne, Switzerland.

Design of efficient organic nonlinear optical (NLO) materials attempts a molecular hyperpolarizability β2₂ₓ up to a value close to 10⁶¹⁰⁻³⁰⁹ m/V and seeks for an orientation of β₂ₓ axes that optimizes either frequency doubling (SHG) or the electro-optic (EO) effect of macroscopic crystals [1-3].

On account of a low yield [1-3] of crystal structures providing a parallel alignment of dipole (max. EO effect), recent interest focused on the packing of NLO molecules along parallel channels of inclusion type lattices [4]. When compared to other host materials [5], perhydrophencylene (PHTP) worked out to be ideally suited [6,7] to include a variety of linearly shaped NLO entities of the A–π–D type (A, D-acceptor, donor group, respectively; π: thiophene, stilbene, polyphenyl, polyacetylene). SHG powder tests revealed that PHTP (A–π–D) inclusion formation produces polar materials at a yield of around 75% that is 3 times higher than found for corresponding single component systems. Crystals of PHTP (A–π–D) were grown by (i) controlled isothermal evaporation of 2-butanone or paraffin, (ii) the temperature difference technique, and (iii) by sublimation [8].

MS16.03.06 GROWTH AND CHARACTERIZATION OF (Y,Nd)Al₃(BO₃)₄ AND (Y,Gd)Al₃(BO₃)₄ CRYSTALS. Leonyluk, N.I., Koporulina, E.V., Belokoneva, E.L., Titov, Yu.V., Moscow State University, Russia.

The crystals of solid solutions based on the Y₃Al₅(BO₃)₄, Nd₃Al₅(BO₃)₄ and Gd₃Al₅(BO₃)₄ borates with untite type structure (R₃m space group) are excellent materials for laser and acoustics devices [1,2]. However, the NdAl₃- and GdAl₃-borates and their solid solutions tend to the phase transitions from untite type structure into monoclinic modifications [3]. The purpose of the present work was to establish a correlation between the growth conditions, contents of crystals and phase transitions in (Y,Nd)₃Al₅(BO₃)₄ and (Y,Gd)₃Al₅(BO₃)₄ solid solutions.

These crystals were grown from a K₂Mo₃O₁₀-containing fluxed melts in temperature range 1060-990°C (spontaneous crystallization) or 1050-1010°C (TSSG).

The distribution coefficient (K=Cₛ/C₁) was estimated to be.