

transformation, a direct relation or a common subgroup with physical or chemical sense through group-subgroup relationships cannot be established [2]. How to deal with disruptive phase transformations using symmetry concepts is an open question very interesting to study.

[1] Elliot, J.C. & Young, R.A. (1968) Bull. Soc. Chim. France. (No. special), 1763.

[2] Ulrich Müller, private communication.

Keywords: group-subgroup relationships, phase transitions and structure, point defects

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Phases and structures of $K_xNa_{1-x}NbO_3$ (KNN) at the high sodium end

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Sodium potassium niobate $K_xNa_{1-x}NbO_3$ (KNN) is a possible lead-free piezoelectric material to substitute for lead zirconium titanate (PZT), which is the leading material in piezoelectric applications. However, the presence of Pb in PZT makes it toxic, and it is for this reason that lead-free piezoelectrics are sought after. This newer lead-free material is united with PZT in that there is a region in their phase diagrams where there appears to be a sudden change in crystal structure. This region has been termed the Morphotropic Phase Boundary (MPB) and appears to coincide with the maximum piezo-response. Of particular interest in $K_xNa_{1-x}NbO_3$ (KNN) is the presence of three morphotropic phase boundaries (MPB) that occur at $x = 0.18$, $x = 0.35$, and $x = 0.48$. The phases of sodium potassium niobate over the whole concentration range at various temperatures have been studied, especially at the high sodium end near the phase boundary at $x=0.18$. Several neutron diffraction experiments at room temperature and low temperatures were made at the ILL, Grenoble and the phases and structures were carefully refined. X-ray powder diffraction experiments and birefringence measurements of single crystals were carried out in the University of Oxford to complement the neutron work and to complete the phase diagram.

Keywords: morphotropic phase boundary, sodium potassium niobate, neutron and X-ray scattering

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Transparency and structure of eye lens studied by high-pressure small-angle X-ray scattering

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Short range, liquid-like order of the crystalline proteins, especially α -crystalline, accounts for eye lens transparency. On concentrating cytoplasmic crystalline proteins, it was reported that eye lens became transparent and that its scattering showed decreasing at low S as well as more pronounced side maxima at 0.007 \AA^{-1} of S , *i.e.*, typical

character of structure factor of DLVO potentials. Applying high pressure less than 100MPa is not supposed to unfold α -crystalline, rather to perturb particle interactions by diminishing hydrophobic and increasing electrostatic interactions. High pressure is therefore an important tool to characterize protein-protein interaction on physicochemical basis. We measured in situ high pressure transition of rat eye lens nucleus at post natal days (PND) 14 to 20 by high pressure small-angle scattering (HP-SAXS) as well as light absorption. All HP-SAXS data were collected at RIKEN beamline BL45XU/SPring-8. At 15°C on ambient pressure they were turbid. Applying high hydrostatic pressure, eye lens got transparent over ca. 80 MPa and turbid again upon decompression, which was found to be reversible. Upon compression the scaled HP-SAXS curves decreased at small S and interestingly, side maxima 0.007 \AA^{-1} of S , feature of DLVO potentials, became less pronounced. In transparent eye lens at high pressure environment, the structure order of eye proteins seems uniform. We will report further on the basis of structure parameter changes obtained by HP-SAXS.

Reference

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Structure and phase transition in a lead-based inorganic-organic perovskites $C_5H_{10}NH_2PbI_3$

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$C_5H_{10}NH_2PbI_3$ has a lead-based inorganic-organic perovskites structure consisting of semiconducting parts which are composed of one-dimensional chains of face-sharing lead-iodide octahedra and barrier parts composed of $C_5H_{10}NH_2^+$ molecules. The lead-iodide chain is isolated by the organic molecules to be a quantum wire, so this material can be regarded as a naturally self-organized one-dimensional system. The crystal structure at room temperature is orthorhombic with space group of $C22_1$. It has been shown by Raman scattering, DSC and optical absorption measurements that the structure undergoes temperature-induced successive phase transitions: phase IV at room temperature, phase III for 255.5K to 284.5K, phase II for 250K to 255.5K and phase I below 250K, which involve rotational/orientational ordering of the organic $C_5H_{10}NH_2^+$ parts. However, its precise structure has not been determined yet. We have been studying structure and phase transition in this material by combining the data obtained by neutron and x-ray single crystal diffraction, and found drastic structural changes take place in the successive phase transitions. The lattice parameters shows step-like changes at the transition temperatures with considerable large contraction of lattice b . Below 285K, 400 peak is found to separates in two indicating that the crystal lattice changes from orthorhombic to monoclinic below 285K. The angle between the splitting peaks increases linearly with decreasing temperature down to 255K and decreasing again up to room temperature without any hysteresis. Below 255K, diffuse peaks appear at the reciprocal points at which reflection is forbidden in the C -centered lattice. These results show