

**12.5-06** A NEW FORM OF NA-KURROL SALT STUDIED BY POWDER-PROFILE X-RAY DIFFRACTION. By A. Immirzi and W. Porzio, Istituto di Ingegneria dell'Università, Salerno and Istituto di Chimica delle Macromolecole del CNR, Milano, Italy.

Polymeric phosphates are being studied by means of powder profile X-ray diffraction (Rietveld method), using constrained refinement techniques (A. Immirzi, Acta Cryst. (1980) B36, 2378-2385; A. Immirzi, Gazz. Chim. Ital. (1980) 110, 381-387). Samples of Na-Kurrol salt type B (K.H. Jost, Acta Cryst. (1963) 16, 640-642), under prolonged grinding, are transformed into a more dense modification of higher crystallographic symmetry. The linear  $(PO_3)_n$  anionic chains, which have approximate  $4_1$  helix conformation in type B phase gain exact  $4_1$  conformation and the crystallographic symmetry changes from  $P2_1/n$  to  $I4_1/a$ . Crystal data are:  $a=b=13.167$ ,  $c=5.925$  Å, 16  $NaPO_3$  units per unit cell,  $D_c=2.64$  g cm<sup>-3</sup>. Structure determination was based only on X-ray powder diffraction data. The tetragonal symmetry was inferred from the 20 positions of a number of resolved peaks and the structure, deduced by trial, was refined by using the Rietveld method combined with constrained refinement according to two models with different degrees of freedom. In the first model fixed P-O bond lengths and free coordinates for  $Na^+$  cations were used (11 variables), thus resulting in a final disagreement index  $R_2 = \sum |I_{obs} - I_{calc}| / I_{obs} = 0.058$ . In the second model, the variables were reduced to 8 by imposing the local  $C_{2v}$  symmetry on each  $PO_2$  unit and the  $R_2$  obtained was 0.063. The reduction of the number of structural variables appreciably increases their reliability. The resulting P-O-P and O-P-O bond angles as well as the O...O and  $Na^+ \dots O$  packing distances are comparable with the values obtained in analogous compounds by means of single-crystal techniques.

**12.5-07** POWDER NEUTRON DIFFRACTION STUDY OF THE NONSTOICHIOMETRIC SOLID SOLUTION OF LITHIUM TANTALATE  $9LiTaO_3 \cdot Ta_2O_5$ . By A. Santoro, R. S. Roth, and M. Austin, National Measurement Laboratory, National Bureau of Standards, Washington, DC 20234, USA.

The defective structure of nonstoichiometric  $LiTaO_3$  has been investigated with the powder neutron diffraction technique and the profile fitting method of Rietveld (J. Appl. Cryst. (1969) 2, 65). The tantalum compound was selected instead of  $LiNbO_3$  to avoid the complication that might arise with the possible reduction of  $Nb^{+5}$  to  $Nb^{+4}$ . The composition  $9LiTaO_3 \cdot Ta_2O_5$  was chosen to introduce in the structure the largest possible number of defects allowed in the solid solubility range of  $Ta_2O_5$  in  $LiTaO_3$ . The use of the powder method was adopted to avoid the need to grow large, homogeneous, and well-characterized, single crystals. The neutron diffraction data were collected with the five-detector diffractometer at the National Bureau of Standards reactor (Prince and Santoro, Natl. Bur. Stand. US Tech. Note 1117 (1980) pp. 11-12). Of the models proposed for explaining the deviations from the ideal composition of  $LiTaO_3$ , those of Lerner, Legras, and Dumas (J. of Crystal Growth (1968) 3, 231), of Nassau and Lines (J. Appl. Phys. (1970) 41, 533), and of Raeuber (Current Topics in Materials Science (1977) Vol. 1, ed. E. Kaldis, North Holland Publishing Co.) have been considered. Statistical tests on the results of least-squares fittings to the experimental data favor the model of Nassau and Lines (loc. cit.) over the other two.

**12.6-01** DISORDER SCATTERING IN NEUTRON POWDER DIAGRAMS. By H. Boysen, Institut f. Kristallographie d. Universität, München, FRG.

Different kinds of disorder in crystals (0-, 1-, 2-, 3-dimensional, static or dynamic) give rise to diffuse intensity in reciprocal space in the form of peaks, streaks, planes and in the whole volume, resp. In a powder diagram this appears as a characteristic modulation of the background, which can be described by characteristic (corresponding to the dimensionality) functions containing the resolution of the diffractometer. From a refinement program valuable information on the parameters of the disorder can be drawn. In combination with the Rietveld program this also eases the treatment of the background. The reactor hall background has to be subtracted via a measurement with the empty can.

The case of glassy carbon serves as a good example, since it shows strong diffuse scattering of different origins. Glassy carbon consists of a network of folded fibrils constructed of graphitic carbon ribbons packed together in random orientation. This leads to diffuse peaks ( $hk0$ ) and streaks ( $hk\zeta$ ), an intense small angle scattering from small pores, incoherent scattering of carbon and 3-dim. disorder scattering from incorporated hydrogen. All these components have been included to refine the total pattern. An excellent agreement is found between the calculated and observed profiles. Parameters like particle sizes, strains, amount of H, interlayer distances, etc. can be determined.

**12.7-01** THE FORMATION OF DEFORMATION TEXTURE IN STEELS UNDERGOING MARTENSITE TRANSFORMATIONS. By V.I. Yushkov, R.A. Adamesku, T.M. Gapeka, Ye.S. Machnev and P.V. Geld, Urals Polytechnical Institute, Sverdlovsk 620002, USSR.

An investigation by X-ray diffraction has been carried out on the peculiarities of texture formation in maraging-type steel having 15% Cr, 5% Ni and 2% Cu, and undergoing martensite transformation during heating and cooling, as well as during cold plastic deformation.

It has been found that hot rolling of the steel results in the formation of strained austenite texture in central layers of the sheet, this texture being characteristic of f.c.c. metals and alloys having high stacking fault energy. It is described by (135)  $[21\bar{1}]$ , (110)  $[001]$ , (110)  $[\bar{1}12]$  and (100)  $[001]$ -components. In contrast, the texture in the surface layers of the sheet is characterized by preferred orientation of (111)  $[01\bar{1}]$ - $[\bar{1}12]$ , (100)  $[011]$  and (211)  $[01\bar{1}]$ -types. The formation of the latter is due to friction.

The non-uniformity of austenite texture along the gauge of the sheet is inherited by martensite texture as well. In addition, the preferred orientations of martensite and the components of austenite texture have a Kurdumov-Sachs relationship.

The martensite texture in the central layers of the sheet is characterized by (111)  $[\bar{1}12]$ , (211)  $[01\bar{1}]$ , (100)  $[011]$  and (311)  $[01\bar{1}]$ -components, and that in the surface layers by (110)  $[\bar{1}12]$ , (110)  $[\bar{1}11]$  and (211)  $[\bar{1}11]$ -components.

Strain martensite whose orientation coincides with that of quenching martensite is formed during the cold rolling of the investigated steel. Such strain-induced phase transformation makes a significant contribution to the mechanism of deformation.