**05.1—27   THE EFFECT OF COOLING RATE ON
α-PHASE ORDERING IN Cu-25at.%Al ALLOY.**
By Z.Bojarski, J.Lelątko, J.Kwarciak and
H.Morawiec, Institute of Physics and
Chemistry of Metals, Silesian University,
Katowice, Poland

The presence of α_2 or α_3-superstructure was
studied by electron microscopy on samples
consisting of $\alpha + \gamma_2$ eutectoid cooled from 500°C
to 25°C at a rate from 25°C/min. to 0.2°C/min.
The D-parameter which determinates the
position of the superstructure spots in the
reciprocal lattice was used to describe the
kind of superstructure. With decrease in
cooling rate the D-parameter increases. The
value of $D=0.357=5/14$ was obtained for α_3-
phase at a higher cooling rate and $D=0.375=3/8$
corresponds to the α_2-phase at the lowest
cooling rate. With decrease of cooling rate an
increase of ordered α_2-regions was observed in
the dark field image.
The ordering of α-phase was also studied for
isothermal annealing at 240°C and 300°C for
300 hours. The lower annealing temperature
formed the α_3-superstructure whereas annealing
at 300°C - the α_2-superstructure.
The studies of the ordering process was
carried out by measuring the heat of the ther-
mal effect by DTA and DSC methods. The magni-
tude of the thermal effect during heating of
the ordered samples was dependent on the
degree of α-phase order. A correlation was
stated between the D-parameter and the heat
absorbed due to disappearance of order in the
α_2-superstructure while heating.

**05.1—28   INVESTIGATION OF THE X-RAY WAVE-LENGTH DEPEN-
DENCE OF A CRITICAL DIFFRACTION EFFECT AT THE PHASE
TRANSITION OF V_3O_5.** By S. Åsbrink, Department of Struc-
tural Chemistry, Arrhenius Laboratory, University of
Stockholm, S-106 91 Stockholm, Sweden, L. Gerward, Labo-
ratory of Applied Physics III, Technical University of
Denmark, DK-2800 Lyngby, Denmark and J. Staun Olsen,
Physics Laboratory II, H.C. Ørsted Institute, Universi-
ty of Copenhagen, DK-2100 Copenhagen, Denmark.

In a previous X-ray single crystal diffraction investi-
gation of the phase transition in V_3O_5, an instantaneous
strong increase in peak intensity together with a peak
broadening was observed for the strong reflexions at the
phase transition temperature 155°C, MoKα-radiation be-
ing used (Åsbrink and Hong, Nature (1979) 279, 624). In
subsequent measurements using a diffractometer of Bond
type (Łukaszewicz, Kucharczyk, Malinowski and Pietrasz-
ko, Krist. und Techn. (1978) 13, 561), the observations
were repeated with MoKα-radiation; however, no such ef-
fects could be seen using CuKα-radiation (Åsbrink, Woł-
cyrz and Hong, Phys. Stat. Sol., to be published). The
present investigation was undertaken in order to study
the wave-length dependence in greater detail, using a
spectrometer for energy dispersive diffraction (Staun
Olsen, Buras, Gerward and Steenstrup, J. Phys. E:
Scient. Instrum. (1981) 14, 1154). The paper discusses
the experimental results in relation to several possib-
le interpretations of the effect.

**05.1—29   STRESS-INDUCED ELECTROGYRATION AND
GYROTROPIC PHASE TRANSITIONS IN ALUMS.**
By H.-J. Weber, Institut für Physik der
Universität Dortmund, D-4600 Dortmund, FRG

We have performed the first measurements of
stress-induced electrogyration in crystals.
In methylammonium aluminium alum (MASD) most
of the impact of externally applied pressure p
on electrogyration ($\delta\rho/\delta E$) can be traced back
to an interference of induced birefringence
with induced optical rotation. Nevertheless
it is possible to work out another intrinsic
effect which is described by $\delta^2\rho/\delta E\delta p$. It has
a value of 10^{-17} deg·m^3/V·N, changes its sign
at about 210 K and increases drastically near
the phase transition at 177 K.

Furthermore we have measured the effect in
chromium-doped MASD-crystals and in hydrazine-
and ammonium- aluminium alums. The results
show that the phase transitions in different
alums are similar in respect to their
gyrotropic character although they differ
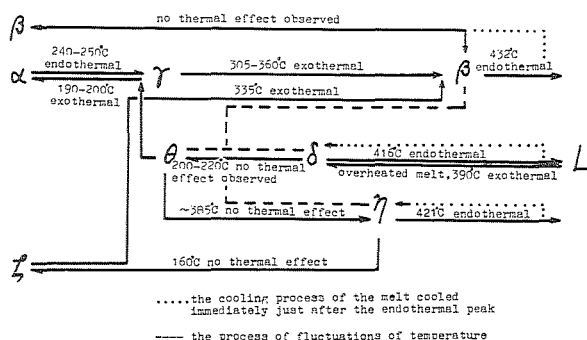in their ferroelectric behaviour.

**05.1—30   ON THE SYSTEMATIZATION OF CONTINUOUS
TRANSFORMATIONS FOR STRUCTURAL TYPES.** D.M.Mazo,
Institute of Solid State Physics, Academy of
Science of the USSR, Chernogolovka. Among dif-
ferent structural types that falls into the gi-
ven space group part is not capable to continu-
ous transformations (T) due to the change of
the scalar external parameter, the others can
undergo these T by one or several ways. Within
the limits of a given space group structural
types differ from one another by the number and
(or) kinds of regular systems of points (RSP)
occupied by elements of structure. For cubic
structures number of different RSPs comes to
154, among which the 55 are met in different
space groups and rest are unique. Six space
groups ($P2_13, I2_13, P4_332, P4_132, I4_132, I\overline{4}3d$) con-
tain exceptionally unique RSPs. The number of
dissimilar regular systems of points related to
one site of Bravais lattice (RSPB) reduces to
127 among which the 69 are unique. Only the
space group $I\overline{4}3d$ is described by exceptionally
unique RSPBs. Crystall-geometrical analysis of
topological relations between RSPs(RSPBs) make
it possible to reveal all the Ts for all struc-
tural types and find the symmetry of external
parameter assisting the given transformation of
the RSP (within a given crystal symmetry class
or between classes) and illustrate possible me-
chanisms of transformations. The present paper
describes the Ts that are within the limits of
cubic structures due to the change of a scalar
external parameter and correspond to the fol-
lowing topological relations: (1) an RSP com-
prises several RSPs, (2) two RSPs coincide at
certain values of free parameters in the points
coordinates, and (1+2). It is found that the Ts
by type (1) can occur in structures in which,in
particular, the occupied RSPs have the multipli-

city ratio N:N (N=1,3,4,6,8,12,16, 24,32,48) or M:3M (M=1,2). Structures in which the occupied RSPs have one, two or three free parameters in the points coordinates can undergo Ts by type (2). The number of free parameters will be reduced by one or by two for the transformed RSP. Transformations by type (1+2) are possible in structural types where simultaneously two or more RSPs of the same symmetry and with the different absolute values of free or/and fixed parameters are occupied. The above Ts are analyzed on conditions that the number of structure elements in the unit cell is constant or changed. The displacements of points of an RSP are due to the expansion coefficients of pair bonds with respect to any scalar external parameter (temperature, hydrostatic pressure, dimension of structure elements) are different even in macroscopically isotropic structures, for example between similar, but unequally spaced structure elements, or between different, but equally spaced elements. Crystallochemical approach to the analysis of continuous transformations should also take into account the real dimensions of the structure elements and the values of tolerance factors for different coordinational polyhedrons. The obtained system of transformations comprises all the second order transitions considered by the theoretical-group methods and some others, for example $Pm3m \rightleftharpoons P23$, $Im3m \rightleftharpoons I23$, $Fm3m \rightleftharpoons F23$ e t c. The thermodynamical analysis was not performed but the coordinates of moving points may be used as a parameter of the free energy expansion.

The crystal systems and lattice parameters of these new phases are follows:

δ_1 -LiIO$_3$; cubic, a=6.968Å

η ; tetragonal, a=11.563Å, c=9.342Å

θ_1 ; orthorhombic, a=5.722Å, b=9.505Å, c=10.589Å

θ_2 ; orthorhombic, a=7.870Å, b=7.970Å, c=7.356Å

ζ ; orthorhombic, a=6.498Å, b=7.118Å, c=12.265Å

There are three phases of LiIO$_3$, β , η and δ , existing relatively stably in high temperature and they can directly melt respectively. Their melting point correspodingly are:

phase β ---432°C;

phase η ---421°C;

phase δ ---416°C;

Their melting point, thermal process and the existing temperature range all show, that the order of their thermodynamical stability is:

$$\beta > \eta > \delta$$

In dry air and at room temperature, the ζ -LiIO$_3$ stands long periods of time without any change as well as phase α and β. At the existing temperature range of α -LiIO$_3$, phase ζ does not transform into phase α , although it is heat-treated for a long time. The temperature of phase transition of ζ to β is higher than that of α to β . The existence of phase β in the phase ζ has a promotive effect on the phase transition of ζ to β just as α to β. The existence of phase ζ in the phase α has also a promotive effect on α to β , the phase θ , as the phase γ , is also an intermediate metastable phase in the phase transition processes of LiIO$_3$.

05.1—31 THE STUDIES ON THE PHASE TRANSITION OF LiIO$_3$. By Liang Jing-kui, Zhang Yu-ming, Institute of physics, Academia Sinica, BEIJING, China.

The phase transition mechanism of LiIO$_3$ at normal pressure has been studied by DTA, DSC, isothermal heat-treatment, and X-ray powder diffraction at high and room temperature.

When over-heated melt is cooled and solidified, we have discovered four new phases of LiIO$_3$---- a group phases δ , η , ζ and θ (θ_1 and θ_2), which are formed by cooling from two main kinds of δ phase. The phase transition processes of LiIO$_3$ as shown in the following diagram:

05.1—32 PHASE TRANSITIONS AND DECOMPOSITION IN KFeF$_4$, RbFeF$_4$, RbVF$_4$. By R. Deblieck[1], J. Van Landuyt[1], B.J. Garrard[2], B.M.R.Wanklyn[2] and S. Amelinckx[1]. /1/ Universiteit Antwerpen, RUCA, Groenenborgerlaan 171, B-2020 Antwerp, Belgium. /2/ Clarendon Laboratory, Oxford University, Oxford OX1 3PU, United Kingdom.

In perovskite (ABX$_3$) compounds such as CaTiO$_3$ and NaNbO$_3$ phase transitions due to the condensation of soft modes occur and can be interpreted in terms of the tilting of the BX$_6$ octahedra around one or some of their tetrahedral axes in the low temperature phases. Glazer (Acta Cryst.(1972).B28, 3384), classified the structure of these phases in terms of the correlation of tilting along these axes. In the ABX$_4$ compounds these octahedra are not, unlike the perovskite case, vertex-shared in the third dimension. Still all of these materials undergo transitions which may be interpreted in terms of condensation of soft modes, yielding low temperature phases with tilted octahedra (M.Hidaka et al.,J.Phys.C.Sol.St.Phys.(1979).12, 2737; J.Phys.C.Sol.St.Phys.(1979).12, 1799; Phys.stat. sol.(a)(1982).72, 809). Electron diffraction experiments are reported which confirm some of these transitions. In RbFeF$_4$ however it is found that, although the reflections are quite weak, the c-axis is doubled at room temperature (RT) whereas this doubling disappears when cooling down to liquid nitrogen temperature (LNT) as can be seen in fig.1. This would invalidate the RT structure proposed by M. Hidaka et al. (J.Phys.C.Sol.St.Phys.(1979). 12, 1799). In RbVF$_4$ there are indications that, in contradiction with the description by M. Hidaka et al.(Phys.stat.sol. (a)(1982).72, 809), the doubling of the c-axis does not vanish at 413K. All of the investigated compounds seem to be very sensitive to decomposition under electron irradiation, probably through evaporation of fluorine. This evaporation forces the BX$_6$ oxtahedra to become locally edge-shared thus deforming the lattice, which