15.5-2   HIGH PRESSURE X-RAY DIFFRACTION MEASURE-
MENTS ON POTASSIUM NITRATE USING SYNCHROTRON
RADIATION. By D. M. Adams,[1] P. D. Hatton,[2] A. E. Heath,[1]
and A. Norman.[1]

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Potassium nitrate (KNO₃) exhibits complex polymorphism
with seven polymorphs in the pressure range 0.0-4.0 GPa.
We have studied this material at room temperature as a
function of pressure up to 9.3 GPa using energy dis-
persive powder diffraction at the SERC Synchrotron
Radiation source (SRS). We have confirmed the structure
of phase IV refined by neutron diffraction at 0.36 GPa
(Worlton et al., Physica 136B (1986) 503), orthorhombic
Pnma, z = 4. The compressibility measured in the range
0.3-9.3 GPa is found to be anisotropic with the axial
compression ratios a:b:c = 1.00:0.64:0.50. The differ-
ing merits of both X-rays and neutrons for high pressure
studies are discussed.

crystal. We confirmed dislocations grew steadily in
whitish part in (a). After the transformation to bcc,
the spot in the same reflextion point as in (a) consists
of a lot of crystallites almost in the same orientation
within several tens miniutes as is seen in (b). Internal
strains induced in the martensitic transformation from
hcp to bcc are easily relaxed mainly by slip. With
decreasing temperature, a part of the crystal (b)
transform into the hcp structure with very large strain
as seen in (c). In the martensitic transformation from
the hcp into bcc structures, the (0001)$_h$ plane is
converted into the (110)$_b$ plane uniquely. Meanwhile, in
the reverse transformation each of six {110}$_b$ planes has
equal possiblity to transform into the (0001)$_h$ plane.
Therefore a hcp crystal transform into a bcc crystal
containing some imperfections, but a bcc crystal
transform into a large number of hcp crystal grains via
the state shown in (c).

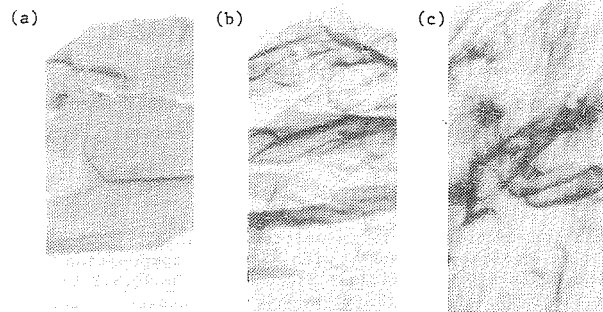(a)   (b)   (c)

Figure. A part of section topographs of the martensitic
transformation in helium-4 from (a) hcp phase at
27.9 atm via (b) bcc phase at 28 atm and (c)
mixed state at 28 atm to hcp phase.

15.6-1   OBSERVATIONS OF MARTENSITIC TRANSFORMATION
AND SOME BEHAVIUORS OF LATTICE IMPERFECTIONS IN HELIUM-4
CRYSTALS BY SR X-RAY TOPOGRAPHY. By Hideji Suzuki,
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Solid helium is a representative of quantum
crystals, because of very large zero point amplitude of
about 30 % of lattice spacings. SR X-ray topography is
the only feasible method for in situ observation of
quantum mechanical behaviours of dislcations in helium
crystals at temperatures of mK region. However, we have
to solve some inevitable technical difficulties caused by
irradiation heating, the small atomic scattering form
factor of helium and the uncontrolled orientation of a
helium single crystal.
This experiment is at a preliminary stage to develop
techniques to get over all difficulties and is limited to
temperatures of liquid He-4. We succeeded to take some
topographs by TV and nuclear research plates (Ilford L4),
in which imperfect structures and their behaviours with
temperatures and pressures can be observed.
The sample chamber is made of stainless steel with
two Be windows of 1.2 mm thick and 10 mm in diameter.
The size of a helium crystal in the direction of incident
X-ray beam is 10 mm. Helium crystals in the hcp
structure were grown under 35.6 atm by cooling the sample
chamber from its bottom. Usually we obtained a large
crystal together with a few small crystals at the corners
of the sample chamber. A nuclear research plate was set
at 58 mm behind the center of the sample chamber, to take
transmission type X-ray topographs.
We took section topographs in beam of 0.1 × 6.5 mm²
to obtain well-resolved images of sub-structures as shown
in Fig. (a), (b) and (c). The topograph (a) is a part of
the reflection from (2̄134) plane of an as-grown hcp

15.6-2   EXPERIMENTAL RESULTS OF TRIPLET PHASE
DETERMINATION USING SYNCHROTRON RADIATION. By E.
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Recent progress of experimental triplet phase determination
for noncentrosymmetric light atom organic structures with
medium size unit cells is reported. The phase information
can be extracted from the three-beam profiles of a Renninger
psi-scan experiment (K. Huemmer, H. Billy, Acta Cryst.
(1986), A42, 127-133). The measurements were carried out
with a special Psi-Circle-Diffractometer (K. Huemmer, H.
Billy in Crystallographic Computing 3, (1985) ed. G.M.
Sheldrick et. al.) installed at the storage ring DORIS in
Hamburg. The six circles of the diffractometer are computer
controlled, the angular resolution is 0.001°.
There are several advantages using synchrotron radiation. The
high energy resolution (Si,Ge(111) two-crystal monochromator)
and the small divergence of the incident beam results in an
excellent angular resolution of the multiple-beam psi-scan
profiles. The total angular width of the three-beam
interaction range is smaller than 0.1°. This is mainly due to
mosaicity of the crystals, which is indicated in the
three-beam psi-scan profiles but cannot be seen in two-beam
profiles. The wavelength can be adjusted so that there is no
overlap with adjacent multiple-beam cases. But some
problems arise from the source instabilities.
A number of triplet phases were determined and compared
with the calculated values of the known crystal structures. It
is shown that the triplet phases can be determined with an
accuracy of about 45° comparing the profiles of the two
centrosymmetric correlated three-beam cases. Then, the
absolute configuration can also be fixed.