

short note

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Pressure-Induced Changes in the Mosaic Structure
of RbI Measured with 412-keV γ -Rays¹⁾

By

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Measurements of the pressure dependence of the mosaic distribution of crystals have not been reported up to now. Such measurements have become possible as a result of recent advances in the development of the γ -ray diffraction method (1, 2). In the case of crystals approaching a first order pressure-induced phase transition the pressure effects on the mosaic distribution may give some insight into the transformation mechanism.

We studied the mosaic structure of RbI under pressures up to 3.4 kbar (RbI transforms into the CsCl structure at 3.56 kbar (3)). For comparison, we also investigated the mosaic structure of KBr in the same way. KBr has a higher cohesive energy and a higher pressure necessary for the transition into the CsCl structure (16 kbar, (4)) than RbI. Thus our working pressure of 3.4 kbar may be considered high for RbI, but relatively low for KBr; consequently the effects to be expected are smaller than in the case of RbI.

The measurements were done on the γ -ray diffractometer at the Institut Laue-Langevin (Grenoble). Rocking curves from different Bragg reflections were measured at various pressures. In the case of RbI, a continuous reduction of the mosaic width with increasing pressure was found (see Fig. 1), which can be interpreted as an alignment of the mosaic blocks. At 3 kbar this reduction was about 12%. In ad-

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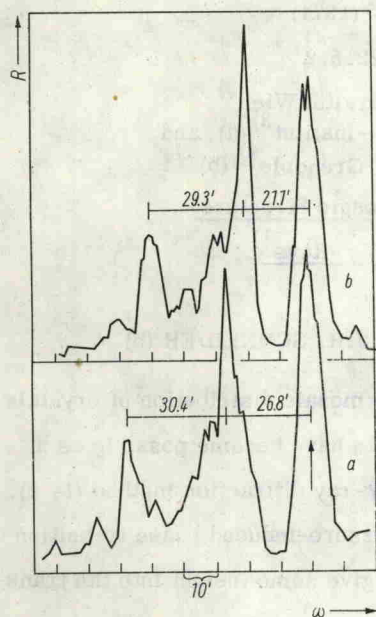


Fig. 1. Rocking curves of RbI (111); reflecting power (R) versus the crystal rotating angle (ω), a) 0 kbar, b) 3 kbar

dition, the integrated reflecting power decreased continuously with increasing pressure (see Fig. 2). The reversibility of these effects in RbI could not be investigated. The pressure chamber burst at 3.5 kbar, the RbI crystal became seriously damaged and the shape of the mosaic distribution was changed significantly.

No such effects were observed in the case of KBr. However, with both crystals, small changes were detected in the shape and the splitting of the various peaks which, as observed in the case of

KBr, were irreversible (inelastic dislocation mechanisms).

With RbI, the systematic decrease of the intensity may be due to some phenomena preceding the transition. A similar intensity reduction has been observed by means of X-rays by Menary et al. (5) with CsCl. In this case, the temperature-induced transition into the NaCl lattice started at temperatures considerably below the transition point. Menary et al. proposed two possible alternative mechanisms for this intensity reduction: an anomalous phonon frequency shift, or an increase in lattice defects. Using RbI, recent measurements of phonon frequency shifts under pressure do not seem to explain the intensity reduction (6). Thus the decrease in intensity may be interpreted as being due to an increase of lattice defects which,

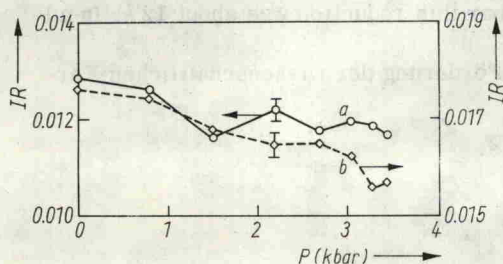


Fig. 2. Integrated reflecting power (IR) of RbI (111) versus pressure (P) (a) of the whole rocking curve, (b) of the peak marked with an arrow in Fig. 1

in turn, may be caused by the formation of germs of the new phase at pressures far removed from the transition pressure, as has been noticed in (7) for RbCl.

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