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Thermal diffuse scattering of X-rays from single crystals of benzil.

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In a number of previous publications various authors (Lonsdale & Smith, 1941; Banerjee, Sen & Khan, 1945; Sen, 1947) have reported the results of the study of the positions of the extra spots and streaks of benzil, but the shapes and forms of the scattering domains around the reciprocal-lattice points of this crystal are not known. In this communication the forms of the equi-scattering surfaces around the reciprocal-lattice points of benzil determined by the photographic method are reported.

A small crystal of benzil was mounted on the axis of a cylindrical camera with the [00.1] axis vertical and coinciding with the axis of the camera. Unfiltered X-rays from a North American Philips X-ray diffraction unit was incident on the crystal normal to the axis of the camera. Stationary-crystal photographs were then taken with the X-ray beam making various angles with the [10.0] axis. In these photographs a number of aluminium powder diffraction lines, arising from diffraction of X-rays by a small amount of aluminium powder dusted on the crystal, were also recorded. The distribution of intensity in the extra reflexions was measured with the help of a Moll recording microphotometer. The spots were scanned along lines parallel to the equatorial line at different heights. In the same traversal two aluminium powder diffraction lines were also traversed along with the spots. From the photometric records the variation of the intensity (arbitrary scale) with the horizontal component of the angle of diffraction was determined for the various extra spots and streaks observed in the photographs. The total intensity of the incident beam was not exactly the same for all photographs. The intensities of the extra reflexions measured from the different photographs were, therefore, brought to the same scale with the help of the ratios of the observed peak intensities of a particular aluminium powder diffraction line. Thus the variation of the relative intensities in the extra reflexions with φ, the horizontal component of the angle of diffraction, was computed. Again, since the same scanning spot of light was used throughout for all photometric measurements, the solid angle over which the observation was made differed for different vertical angular coordinates. The relative intensities observed in the extra reflexions at different heights above or below the equatorial line were, therefore, corrected. From these curves giving the variation with φ of the relative intensity, the relative intensities corrected for the general background and the polarization term, $\frac{1}{2}(1+\cos^2\varphi)$, were obtained for different directions of observations. These values of the relative intensities were plotted at the corresponding points in the reciprocal lattice and lines were drawn through points having equal intensity values. The equi-scattering surface thus obtained around the (40.0) reciprocal-lattice point normal to the [00.1] axis is reproduced in Fig. 1(*a*). The equi-scattering surface around (40.2) has been found to be similar. The section of the equi-scattering surface around (40.0) with the reciprocal-lattice plane containing the axis parallel to [00.1] and an axis normal to [00.1] but not passing through the origin has been drawn in a similar manner. This is shown in Fig. 1(*b*). The equi-scattering lines (particularly for the strong scattering regions) in the reciprocal-lattice plane normal to [00.1] are more or less symmetrical about the reciprocal-lattice vector and its normal, whereas the equi-scattering lines around (40.0) in the reciprocal-lattice plane containing the reciprocal-lattice axis parallel to [00.1], as shown in Fig. 1(*b*), are not symmetrical about either the axis parallel to [00·1] or about the plane perpendicular to [00.1]. These features are qualitatively in agreement (Sen, 1952) with the thermal theories of diffuse scattering (Born, 1943; Zachariasen, 1944).

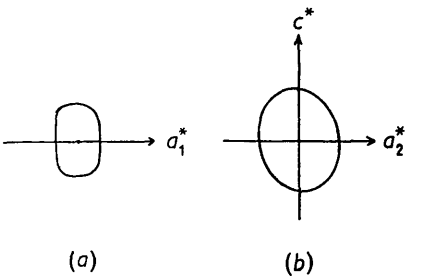

Fig. 1. (*a*) Equi-scattering lines around (40.0) in the reciprocal-lattice plane perpendicular to [00.1]. a_1^* is the reciprocal-lattice axis coinciding with the reciprocal lattice vector. (*b*) Equi-scattering lines around (40.0) in the reciprocal-lattice plane parallel to the [00.1] axis and a reciprocal-lattice axis perpendicular to [00.1] but not passing through the origin. c^* is the reciprocal-lattice axis parallel to [00.1] and a_2^* is the other reciprocal-lattice axis.

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References

BANERJEE, K., SEN, R. K. & KHAN, M. F. (1945). *Proc. Nat. Inst. Sci. Ind.* **11**, 4.

BORN, M. (1943). *Rep. Phys. Soc. Progr. Phys.* **9**, 294.

LONSDALE, K. & SMITH, H. (1941). *Proc. Roy. Soc.* A, **179**, 8.

SEN, R. K. (1947). *Indian J. Phys.* **21**, 285.

SEN, R. K. (1952). *Indian J. Phys.* In the press.

ZACHARIASEN, W. H. (1944). *Theory of X-ray Diffraction in Crystals.* New York: Wiley.