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A comment on Prasad & Srivastava's paper, *The streaking of X-ray diffraction spots in platelet-shaped polytypic crystals.*

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The phenomena of streaking and arcing observed on X-ray *c*-axis oscillation photographs of cadmium iodide are explained respectively in terms of stacking faults and tilt boundaries formed by the alignment of edge dislocations created during crystal growth. The streaking and the arcing on *a*-axis oscillation photographs have already been explained in similar terms.

In the paper quoted (Prasad & Srivastava, 1971) the authors attempted to explain arcing and streaking on *c*-axis oscillation photographs of platelet-shaped CdI_2 and SiC crystals in terms of size and shape-effect. The phenomena of streaking and arcing earlier observed on *a*-axis oscillation photographs of platelet-shaped crystals of CdI_2, PbI_2 and $CdBr_2$ have been understood respectively in terms of random stacking faults and the arrangement of edge dislocations into tilt boundaries (Agrawal & Trigunayat, 1969*a*, *b*, 1970; Agrawal, Chadha & Trigunayat, 1970). The degrees of arcing and streaking were experimentally found to be different in different substances, although the shapes and sizes of the platelets are almost the same, and have been accounted for by the differences in their stacking fault energies arising from their structures (Agrawal, 1971). The streaking and arcing in CdI_2 was also found to be changed upon heating the crystals (Lal, Gulzari & Trigunayat, 1970, 1971) and on re-examination after a few years (Agrawal, 1972), because of dislocation movements. Moreover, the upper and lower parts of a platelet have always been found to display different degrees of arcing and streaking and these observations were attributed to the non-uniform rate of generation of dislocations during growth (Agrawal, 1970). These experimental observations are enough to convince one that streaking and arcing are respectively produced by the stacking faults and the alignment of edge dislocations in a crystal. It is not a size or shape effect. The *c*-axis oscillation photographs in the paper quoted can be easily explained in similar terms as follows.

The spots above and below the zero layer on a *c*-axis oscillation photograph are obtained on reflexion from the upper and lower parts, respectively, of a crystal platelet as the diffracted beams from the middle part are absorbed. There may be or may not be any streaking and/or arcing on one or both sides (Jain & Trigunayat, 1970), depending on the occurrence of random faults and the alignment of edge dislocations in different parts of a platelet. The general scattering producing intense background also depends upon the random distribution of dislocations and vacancies. For example, if the upper part is free from random faults and dislocations, there will be no streaking, arcing or intense background on the upper side of the zero layer. If the lower part contains randomly distributed faults and dislocations and a tilt boundary consisting of edge dislocations, it will give rise to streaking, intense background and arcing on the lower side of the zero layer. The intensity of streaking and background depends upon the density of random faults and dislocations, whereas the shapes and sizes of the arced reflexions are governed by the angle of tilt and the orientation of the axis and the plane of tilt boundary with respect to the incident X-ray beam (Agrawal & Trigunayat, 1969*a*). Therefore, the shapes and sizes of arced reflexions may be different not only in the crystals of two different substances but also in those of the same substance as well as on the left and right sides of the centre of a photograph (see Figs. 1 and 2 of the paper quoted). If this crystal is broken into two pieces along the plane of the boundary, the lower part of either piece will give rise to single spots, not arcs. As the plane of the boundary divides the lower part into two blocks tilted with respect to each other, their *c* axes will make an angle with each other and the *c* axis of the upper part will also make an angle with these two *c* axes. Therefore, it is impossible to align all the crystal parts simultaneously parallel to the beam. The statement in the quoted paper 'two oscillation photographs taken on the same film for two crystal positions (one obtained after rotating the crystal through 180° from the initial position) will show that the positions of the streaked and the sharp reflexions in the same $10{\cdot}l$ row will interchange' seems to be incorrect. The upper and lower parts of a platelet would remain the upper and lower parts even after rotating the crystal through 180° about the oscillation axis. Thus the upper part would give rise to single spots in both the cases and if its *c*-axis coincides with the oscillation axis, the spots would overlap. The shape and size of the arcs on the other side may differ after rotation if the orientation of the blocks about the plane of the boundary changes with respect to the incident X-ray beam. Many crystals of CdI_2 have not shown any streaking or arcing on the *c*-axis oscillation photographs (Jain & Trigunayat, 1970) contrary to the prediction in the paper quoted.

References

Agrawal, V. K. (1970). *Acta Cryst.* A**26**, 567–569.
Agrawal, V. K. (1971). *Phys. Lett.* **34**A, 82–83.
Agrawal, V. K. (1972). *Acta Cryst.* A**28**, 472.
Agrawal, V. K., Chadha, G. K. & Trigunayat, G. C. (1970). *Acta Cryst.* A**26**, 140–144.
Agrawal, V. K. & Trigunayat, G. C. (1969*a*). *Acta Cryst.* A**25**, 401–407.
Agrawal, V. K. & Trigunayat, G. C. (1969*b*). *Acta Cryst.* A**25**, 407–411.
Agrawal, V. K. & Trigunayat, G. C. (1970). *Acta Cryst.* A**26**, 426–429.
Jain, R. K. & Trigunayat, G. C. (1970). *Acta Cryst.* A**26**, 463–470.
Lal, Gulzari & Trigunayat, G. C. (1970). *Acta Cryst.* A**26**, 430–431.
Lal, Gulzari & Trigunayat, G. C. (1971). *J. Cryst. Growth*, **11**, 177–181.
Prasad, R. & Srivastava, O. N. (1971). *Acta Cryst.* A**27**, 559–562.