Table 3. *Euclidean normalizers of symmetry operations and their invariant subspaces*

Symmetry operation *W*	Euclidean normalizer *N* of *W* consists of	Invariant subspace(s) of *N*
Identity	All congruences	None
Translation, vector **t**	Those congruences which conserve vector **t**	None
Reflection in plane *A*	Those congruences which conserve plane *A*	Plane *A*
Glide reflection in plane *A*, glide vector **v**	Those congruences which conserve plane *A* and vector **v**	Plane *A*
Rotation about line *b*	Those congruences which conserve line *b**	Line *b*
Screw rotation about line *b*, screw vector **u**	Those congruences which conserve line *b* and vector **u***	Line *b*
Rotoinversion with respect to line *b* and point *P*	Those congruences which conserve line *b* and point *P*, as well as the sense of rotation	Line *b*, point *P*, and plane perpendicular to *b* through *P*
Inversion	Those congruences which conserve point *P*	Point *P*

* If the rotation angle is not 180°, then the sense of rotation must also be conserved. The normalizer then lacks mirror planes through *b*, for instance. However this does not change its invariant subspaces.

reflection in a plane, for example, the normalizer contains all parallel translations, reflections in all perpendicular planes, *etc.* The short and rather obvious description in the second column of Table 3 is, however, sufficient to yield the invariant subspaces listed in the third column. This latter column is in accordance with the second column of Table 1. The ensuing definition hence becomes: *the geometric element of a symmetry operation W consists of the subspace(s) invariant for all operations belonging to the Euclidean normalizer of W.*

The following remarks apply to Table 3:

(i) The occurrence of three items for the rotoinversion (instead of two in Table 1) is not a discrepancy: if the point is invariant, invariance of the line follows from that of the plane, and *vice versa.* Hence, one of the latter two is redundant.

(ii) 'Subspace' should be taken in the proper sense, because in the improper sense ('all space') it is invariant for any congruence. It would have to be added to all geometric elements but would not increase their information content.

(iii) The invariance need only obtain for the subspace as a whole, not necessarily pointwise as required in the SCIPRO definition.

(iv) It should be noted that the congruence operations referred to above are operations in point space (see *IT*A83, § 8.1.5), not vector space. The given definition of geometric elements hence applies to symmetry operations in point space only, not to those in vector space.

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Notes and News

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The Kathleen Lonsdale Lecture

The 1989 Kathleen Lonsdale lecturer is Dr Robert Diamond, who will deliver the lecture on 12 September 1989 at the Annual Meeting of the British Association for the Advancement of Science, which will be held in Sheffield, England, 11–15 September 1989. The title of the lecture will be 'Crystalline Viruses'.

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. O. Gould, Department of Chemistry, University of Edinburgh, West Mains Road, Edinburgh EH9 3JJ, Scotland). As far as practicable books will be reviewed in a country different from that of publication.

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Dislocations in solids. Edited by F. R. N. NABARRO. Pp xi+434. Amsterdam: Elsevier Science Publishers, 1987. Price Dfl 235.00 or US $94.00.

The successive volumes of the Nabarro-edited series *Dislocations in solids* have over the years been keenly awaited by a large interdisciplinary community of scientists throughout the world. Volume 7, the latest, consists of five chapters (33–37) on different phenomena involving dislocations which have been known for decades but on which new light has in recent years been thrown, thanks to new experimental techniques. The chapters range from relatively short, 42 pages, to those three times as long, 122 pages. They cover phenomena ranging from those – like electrical noise in metals, Ch. 33 by Bertotti *et al.*, and dislocation drag, Ch. 34 by Alshits & Indenbom - which many 'practical metallurgists' might consider to be of hardly any 'practical' importance, to those - like radiation damage/effects, Ch. 36 by Hall, and martensitic transformations, Ch. 37 by Olson & Cohen - which they would. The transition between the two is represented by Ch. 35, by Alexander, on dislocations in covalent crystals, a topic of vital importance to the solid-state electronic device industry.

The topic of electrical noise is constrained by a lack of experimental data so Bertotti *et al.* have confined themselves mainly to aluminium films. While, therefore, the inability to draw general conclusions is understandable, it is difficult to agree with these authors that 'A general quantitative description of the plastic deformation ... in terms of the microscopic behaviour of dislocations ... is still lacking ...'. No apology for working with dislocations for virtually anything should be needed in 1988. This topic is really in its infancy and this article seems to be the first one to give a critical comparison between a theoretical framework and experimental data - however sporadic - hence a much needed one.

The massive reference list (267) of Ch. 34 is indicative of the importance of dislocation drag mechanisms to dislocation theory. The authors have discussed some of the mechanisms in detail, *e.g.* electron drag as well as phonon drag of dislocations, in particular metals. It would have been useful if account had been taken, in the case of ionic crystals such as the alkali and silver halides and magnesium oxide - perhaps ice also - of another possibility, *viz* that of configurationally charged dislocations having a drag due to the charge and subsequent interactions with indigenous and impurity ions. There are indications that this may be a sufficiently important drag mechanism. There is good discussion on radiation friction including a mention of electromagnetic emission due to uniform motion of dislocations in ionic crystals. Perhaps the charged dislocation effect is more important. [An aside: much experimental work in the matter of drag is done, as indicated by the references, in the Soviet Union.] It is correctly pointed out at the end that, among other things, experimental work on radiative dragging at near-sonic velocities is required. If this is forthcoming, we may expect 'relativistic' effects to be manifested - something for which people have been awaiting ever since Frank's paper of 1949.

As remarked (somewhat defensively?) in the *Preface* by the Editor, '... Even those who claim that the study of dislocations has done little to help practical metallurgical design have to admit that it has proved fundamental in semiconductor device technology', and this has been very well brought out in Ch. 35, the longest chapter, massively referenced (293) and well illustrated. A nine-page *Addendum*, which necessitated the last 50 references, has had to be included in proof because of the time elapsed between the original preparation and the printing - an indication of the progress in the field. It is somewhat disappointing to the older generation brought up on 'dangling bonds' of dislocations in silicon and germanium that they really do not exist, in any case not in numbers; but the experimental evidence is too strong to be ignored. From the point of view of technology, some of the findings are that oxygen and carbon are far more important than thought before and that intrinsic defects are produced in unexpectedly large numbers during plastic deformations, and these are well emphasized in the review. A statement by the author on p. 117, *viz* '... a better communication between researchers interested in dislocations and in semiconductor surfaces respectively should be fruitful ...', seems to dilute the Editor's assertion mentioned above. Overall the review will be useful to both types of researchers.

Ch. 36, Hall's review of irradiation effects on the internal geometry of crystals concentrates on dislocation loop and network formation and evolution in irradiated cubic metals, and refers to point defects in relation to that only. The techniques of studying irradiation phenomena now range afar and reviewing the results of all of them is not a realistic proposition. This review happily concentrates on loops, both interstitial and vacancy, and the use of steady-state nucleation theory and chemical reaction rate theory.

The last, 37th, chapter is a review of the dislocation aspect of martensitic transformations, giving the latest thinking on the role of interfacial dislocations and the application of the concept to the mechanism and kinetics of nucleation and growth. The elevation of three obvious statements to the level of *principles* for a kinematic approach to transformation crystallography might appear facetious but in fact correctly serves to emphasize an intuitive approach. One wishes that the review had been illustrated with more than just seven electron micrographs in 112 pages. The last subsection (6.2) on biological martensitic transformations not only is fascinating but also serves to underscore, by pointing our similarly related transformations in materials quite far removed from metallic bonding, that the theoretical framework of the dislocation approach is broadly applicable. This is probably the first review in recent times that has elucidated this approach.

This latest volume of the Nabarro series is thus a welcome collection of reviews on the very wide play of dislocations in diverse phenomena. The printing and editing is of the usual high standard expected from North-Holland and the Editor, and this Reviewer has not found any serious printing or other errors. The price remains out of bounds for individual workers especially in developing countries and the publishers might consider reprinting individual articles from this and the previous volumes for their sake.

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