

varied and disputed. The question is subtle because all sorts of variables need to be specified: simple tension or complex stress system; monocrystalline, polycrystalline or amorphous material; rate of loading; size distribution of cracks, grains, polymer chains; plastic deformation mechanisms available; temperature. The answer is statistical, and even statistical reproducibility is the prize for extreme care in standardizing variables. The interpretations are divided into two fundamentally distinct categories: the microscopic approach, concerned with mechanisms on the atomic scale, and the fracture mechanics approach, in which the solid is treated as a continuum with specified properties—as a black box, so to speak.

The interdisciplinary conference, the record of which is here under review, was convened partly to bridge this duality of approach to the problem of understanding fracture, and partly in the hope that the very different behaviour of crystalline materials and of polymers might result in mutual illumination. The exercise was well worth while, and the book makes most instructive reading, not least for the long, discursive discussions which reveal metallurgists, continuum mechanics specialists and polymer physicists groping to grasp each other's concepts and preoccupations.

Where crystalline materials are concerned, and polycrystalline alloys in particular, the microstructural approach has yielded a rich harvest of understanding, and correlation with the engineering approach has advanced far. Hahn and Rosenfield's "systems approach" to fracture of steels is a striking illustration of this correlation. (An instructive comparison can be made with the largely unsuccessful attempt at another conference, twelve years ago, to marry the microscopic and continuum approaches to plastic deformation.) The continuum approach to polymer fracture has also become quite subtle, but microscopic analyses do not seem to have passed far beyond the descriptive stage; the two approaches have not yet a great deal to contribute to each other. Nevertheless, Rosen's chapter on the generation of microfissures in viscoelastic polymers (analogous to microcracks in metals) is particularly stimulating, and points the way to a wide open field of research. Rosen and McMahon (who writes on the microstructural aspects of tensile fracture of metals) agree that vast numbers of tentative microfissures or microcracks form first and progressively develop to form the large crack that eventually causes fracture. There is no clean break; polymers, indeed, when beset by microfissures, warn of their impending destruction by visibly "blushing", a form of early warning to which politicians unfortunately seem immune.

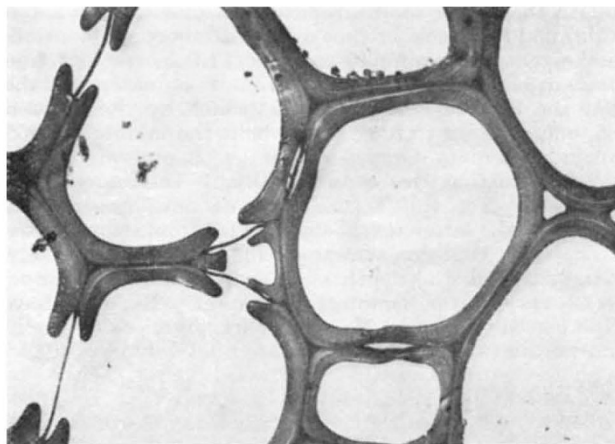
The metallurgists at the conference, accustomed to the primacy of the microstructural approach, appear to have been somewhat nonplussed by the clear lead, in the case of polymers, of rigorous analysis on the basis of purely empirical relationships between strain, stress, time and temperature. Professor Ansell's remark, in discussion, that "structure in a metal is relatively simple, as compared with the polymers, while the behaviour in the metals is much more complex" certainly seems justified to me, trained as a metallurgist. Dr Temin, a polymer man, reacted to this view somewhat acidly: "There seems to be a tendency for those who are most learned in metals to presume the polymer situation to be extremely simple", and Dr Bonis pointed out that we all believe the other man's field to be much easier than our own. His hope that the polymer/crystal dialogue should be helpful has undoubtedly been justified, and the book deserves the attention of fracture specialists of all persuasions.

The individual contributors include Johnston on "Fracture of Polycrystals", Williams on "Fracture in Viscoelastic Media", Hahn and Rosenfield on the "Systems Approach to Fracture", Cossna and Sternstein on "Viscoelasticity and Plasticity Considerations in Fracture of Glassy Polymers", Rosen on "Homogeneous Fatigue Processes in Viscoelastic Polymers", Mould on "Strength

of Inorganic Glasses" (this contribution was rather out on a limb), Stokes on "Fracture of Ceramics", Gurland on "Fracture of Composites", Stoloff on "Effect of Solutes on Fracture of Metals" and McMahon on the "Microstructural Aspects of Tensile Fracture".

R. W. CAHN

INSIDE WOOD



An ultrathin section of red oak (*Quercus rubra* L.) showing bordered pit pairs between tracheids. From *Wood Ultrastructure*, an atlas of electron micrographs, by Wilfred A. Côté jun. (University of Washington Press; 37s. 6d.).

NEW MATERIALS JOURNAL

Journal of Powder Technology

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Powder Technology first appeared in February 1967 and is advertised as a bi-monthly publication. In fact, only four issues appeared during 1967 and the last issue (December) is completely taken up with papers from a conference held at Bradford some three months earlier. Hence, in the practical terms of attracting papers it appears that the journal cannot yet be regarded as having established itself.

Nevertheless, there is a general opinion among colleagues, to whom the first four issues were passed, that the average standard of contribution is good. There is a surprising shortage of papers in the technologically important area of powder characterization in so far as it affects the properties of solids fabricated from powders. This is a serious omission because the current industrial emphasis on the use of automatic methods leans heavily on linking powder characteristics with those of the resulting solid. Generally, the balance of subject matter in these first issues is biased to attract the chemical engineer concerned with handling powders, rather than the material technologist concerned with using them to make solids. This may be because the latter type of paper would more naturally find its way into an existing journal concerned with the particular class of material involved; but this only takes us back to the problem of proliferation of journals and the fact that technological growth points tend to defy existing classifications.

To sum up, this could become a useful journal but unless the editors do more to broaden the scope of the papers, its progress towards becoming established is likely to remain, at best, erratic.

F. J. P. CLARKE