In attempting to interpret the effect of alloying on Q^{-1} it was considered that, at least as a rough approximation, one may have $H_{\max}$ $(c) = H_{\max}$ $(0).$ $[1 + \alpha c]$, where c is expressed as atomic fraction, and α is a constant. If the first fraction in Equation 1 were not significantly concentration dependent at strains corresponding to $Q_{\max}$, which is however an unsubstantiated hypothesis at present, then the relation shown in Fig. 2a would be expected to hold. However, this point requires further investigation.

The energy barrier H_1 should relate to single kinks. If the extrapolation of the lines to about 30 K is accepted, simple considerations show that values of H_1 are of the order of a few meV, i.e. they are of reasonable magnitude to be interpreted in terms of lattice friction.

A point of interest in relation to Fig. 2a is the continuity of the line; there appears to be no qualitative difference between the behaviour of dilute and concentrated alloys. These observations may have implications for the theory of solid-solution hardening [7].

Den Buurman and Weiner [2] find that in their $99{\cdot}999\%$ copper, Q^{-1} was higher at 78 K than at room temperature. This does not invalidate Equation 1, for it is well known that under the experimental conditions used by them the "foot" of the range of Bordoni peaks is observable at 78K [8], and this results in a lifting of the background level of internal friction.

Although some features, e.g. the dissociation of dislocations, in the fcc lattice, have not been allowed for explicitly, the present results point clearly to the pronounced effects of the micro-stress-fields on the internal friction of crystalline materials.

It is probable that the broadening of the Bordoni and Hasiguti peaks results from processes of the type here considered. A more detailed, stochastic, treatment of the entire problem is desirable; this might facilitate dispensing with some of the assumptions which had to be introduced in the derivation of Equation 1.

References

1. W. H. ROBINSON, *J. Mater. Sci.* **7** (1972) 115.
2. R. DEN BUURMAN and D. WEINER, *Scripta Met.* **5** (1971) 753.
3. C. J. SPEARS, *J. de Physique*, **32** (1971) C2-183.
4. P. FELTHAM, *Scripta Met.* **5** (1971) 395.
5. P. FELTHAM and J. D. MEAKIN, *Phil. Mag.* **2** (1957) 1237.
6. P. FELTHAM, *J. Inst. Metals* **89** (1960) 211.
7. G. LEHMANN, *Brit. J. Appl. Phys.* **2** (1969) 126.
8. P. FELTHAM and C. BURDETT, "Realstruktur und Eigenschaften von Reinstmetallen" (Akademie Verlag, Berlin, 1967) p. 615.

Received 15 March and accepted 13 April 1972

C. J. SPEARS
Enfield College of Technology
Enfield, Middlesex, UK

P. FELTHAM
Brunel University
Uxbridge, London, UK

Book Review

Mechanical Properties of Solid Polymers

I. M. Ward

Wiley-Interscience, 1971, pp XV + 375. Price £7

Professor Ward's new book will be welcomed by the increasing number of University teachers giving courses in the physics and mechanical properties of polymers. Previous books in the same field have generally lacked the rigour and didactic quality required for teaching, but these features are well provided by the present volume.

The book is an extended version of lectures given in the Bristol M.Sc. course in the Physics of Materials. The treatment is not abstruse, however, and the book is quite suitable as a text for third, and even second, year honours undergraduates with appropriate backgrounds.

Apart from its usefulness as a textbook, it should also serve as a valuable introduction for research workers and industrial scientists who lack background in the mechanics of polymers but need to consider mechanical properties in the course of their work.

The approach adopted by Professor Ward is largely a continuum one. That is to say that polymeric solids are treated as continuous media and analyses are made in terms of continuum parameters such as stress, strain, elastic constants yield and fracture stresses and so on. The chemical structure and physical microstructure are dealt with only very briefly in the opening introductory chapter (although, of course, structure is implicit in a great deal of what follows, e.g. the theory of rubber elasticity) and in Chapter 8, mechanical relaxation phenomena are related to molecular structure. This lack of emphasis on structure is clearly deliberate and the inclusion of such material would have doubled the length of the book!

The contents are organized in the following way. An introductory chapter deals briefly with molecular structure, crystal structure, the structure of amorphous polymers and crystalline texture. The second chapter is devoted largely to the elements of classical elasticity and the third to rubberlike or finite strain elasticity. The statistical thermodynamical approach to rubber-like deformation is presented in Chapter 4. The next chapter introduces visco-elasticity which is considered by means of conventional spring and dashpot models and the concept of relaxation time. Dynamic mechanical testing and stress relaxation phenomena are then brought in as natural examples of visco-elastic phenomena, and two experimental chapters on visco-elastic behaviour follow.

The interpretation of mechanical relaxations in molecular terms provides the basis for the next chapter and this is followed by a most helpful treatment of non-linear visco-elasticity typical of large deformations and crystalline polymers. Three substantial chapters on anisotropic mechanical behaviour, yield and fracture bring the book to a close.

The text is well written, beautifully printed, and accompanied by a profusion of clear line diagrams; it represents good value for money, even at the published price of seven pounds.

E. H. A.