Applications of electron microscopy to minerals

The seven papers which make up a group in this issue of the journal were among those presented at a specialist symposium entitled "Applications of Electron Microscopy to Minerals" which followed EMCON '72, the Fifth European Congress on Electron Microscopy. The papers cover a wide range of disciplines – phase transformations, deformation, particle track analysis – and indicate the breadth of electron microscope applications in mineralogy.

Studies of the microstructure of minerals are still largely the province of the optical microscope and investigation of mineralogical phase transformations has been, and largely still is, confined to X-ray diffraction techniques. The electron microscopic studies undertaken before 1970 were almost completely confined to the examination of crushed specimens. Such investigations were by their nature limited to the finest microstructures – details of less than a micron in extent. The general availability of commercial ion-thinning machines has revolutionized mineral specimen preparation techniques and thin foils, suitable for transmission electron microscopy, can now be prepared as a matter of routine.

The development of high-voltage microscopes which occurred at much the same time as that of ion-thinning machines, has also proved to be extremely valuable. Not only is there greatly increased penetration at 1000 kV (most minerals are composed predominantly of elements with $Z > 15$), but ionization damage, which is a severe problem in many common minerals (e.g. quartz, feldspars) at 100 kV is greatly reduced at 1000 kV. Quantitative electron microscopy is now possible for the first time with these materials.

It is of interest to reflect that early metallographers drew heavily on the work of geologists to interpret their optical micrographs, even though optical petrography was initially developed by Sorby who is considered to be the Father of Metallography! The position is now reversed and the great wealth of electron-optical observations of microstructures which the metallurgist has collected are now being fruitfully used as reference material by the mineralogist.

Electron microscopy of minerals is proving to be a lively interdisciplinary topic (see for instance the lists of authors in this collection of papers) and one of the true Material Sciences. By publishing this selection of papers, the editors of the *Journal of Materials Science* wish to signal their sustained interest in this new field.

P. E. CHAMPNESS
G. W. LORIMER
R. W. CAHN