08.X-01 UMWEGANREGUNG PROCESS OF MULTIPLE DIFFRACTION IN ORTHOPYROXENENS AND ENARGITE.
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Multiple diffraction effects occur when two or more reciprocal lattice points lie in the surface of the Ewald sphere of reflection at the same moment. These effects may cause misunderstanding for the space-group determination and for intensity measurements.
Together with enargite, forbidden reflections of some described pyroxenens were examined, mainly using the detailed PSI-scanning method on Phillips 1120 automated four-circle diffractometer. All the reflections violating the systematic absences of Pbca-orthopyroxene, C2/c-spodumene, P2/n-omphacite and $Pmn2_1$-enargite were found to be due to the "Umweganregung" process of multiple diffraction phenomenon. The "Umweganregung" peaks observed for the PSI azimuth were indexed using operative and cooperative reflections with strong intensities. This PSI-scanning method is very useful to check the validity of forbidden reflections. The crystal structure of hypersthene has been refined for directly observed effects on multiple diffraction and anisotropic extinction. The R value was improved from 0.026 to 0.017.
The symmetry pattern of PSI scanning can be represented by linear group with periodicity. There are in general six types, namely p1 and pm with the periodicity of 180°, 90° and60°.

08.X-02 NATURAL, HIGH-DENSITY POLYMORPHS OF Mg_2SiO_4 STUDIED BY TRANSMISSION ELECTRON MICROSCOPY.
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Transmission electron microscopy (TEM) of the shocked Tenham meteorite has shown that some olivines in the meteorite have been transformed to their high-density spinel-structure polymorph. The spinels invariably contain stacking faults of the type $a/4$ $[\bar{1}10]$ (110), which cause a relative displacement of the cations, but which leave the oxygen framework unaffected. The rearrangement of the cations, caused by the stacking fault, locally produces regions with the β-phase structure, a further high-density polymorph of olivine. The faults have been interpreted as being an inversion texture, produced as the spinel passes out of its stability field into that of the β-phase.

Recent TEM studies of veins in the shocked Peace River meteorite have also revealed the presence of deformed olivine and its high-density polymorphs. In this case, the inversion from spinel to the β-phase has proceeded further, and whole grains (1-5μm in diameter) of virtually fault-free β-phase have been found. The mechanism by which the spinel ⇌ β-phase transformation occurs appears to be a quasi-martensitic one, in which dislocations propagate through the spinel to produce the $a/4$ $[\bar{1}10]$ (110) faults and local β-phase structure. Initially the faults tend to form on all spinel {110} planes, but as the density of the faults increases it appears that one set becomes dominant and the spinel cation distribution is transformed into that of the β-phase. The possibility of such a quasi-martensitic transformation may have a significant effect on the rheology of spinel and the β-phase near their transformation temperature, and consequently may be of significance to mantle rheology.

08.X-03 INTERFACE THEORY AND THE ORIENTATION OF PHASE AND DOMAIN BOUNDARIES IN MINERALS.
By Michael E. Fleet, Department of Geology, University of Western Ontario, London, Ontario, Canada N6A 5B7.

Minimisation of interface energy is the dominant factor controlling the shape and orientation of crystalline precipitates and replacement products in minerals. The dimensional misfit of strain-free lattices at a phase boundary is directly related to interface energy and provides a convenient criterion to minimise. The contribution of anisotropic elasticity is relatively insignificant except when the lattice misfit is essentially isotropic.
Theories for coincidence and optimal misfit boundaries are developed from consideration of common (hkℓ) planes and applied, respectively, to chain-silicate and feldspar mineral systems. For optimal boundaries, structural continuity across the interface may be improved by local coherency stresses and dislocations. The agreement with observed intergrowth orientations clearly improves when input unit-cell parameters correspond to the temperature of intergrowth formation: the orientation of magnetite inclusions in augite is a sensitive phase boundary geothermometer. Discrepancies with observed orientations arise from topological constraints (e.g. the common development of (010) interfaces in diopside-tremolite and biopyribole intergrowths) and decrease in specific surface area with coarsening.
Minimisation of interface energy is also an important factor in the orientation of domains. This is illustrated by explanation of the compositional dependence of the plane of modulation of the e-plagioclase superstructure.

08.X-04 APPLICATION OF ENERGY DISPERSIVE X - RAY DIFFRACTION FOR HIGH PRESSURE RESEARCH IN MINERALOGY.
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The understanding of the properties of phase transformations of minerals present in the earth mantle requires in-situ X-ray-diffraction experiments at high pressures and elevated temperatures. The recent development of the method of energy dispersive X-ray-diffraction and the progress in high pressure cells allows us to study polycrystalline samples that can be kept over a prolonged time at pressures up to several hundred Kbar and at temperatures around 500 deg.C.

For several reasons we have concentrated our efforts on polycrystalline samples. Our interests in the past years were concerned with the determination of compressibilities of minerals, of the dynamics of phase transformations, and the refinement of crystal structures from powder - diffraction data. As a comparatively new field of research we have made use of the pressure gradient present in a diamond anvil squeezer without a gasket, in order to study the effect of pressure diffusion, and of pressure decomposition and recombination in such a gradient. These effects are likely playing an important factor in the mineralization of ores.

For pressures up to 35 Kbar a miniature piston cylinder press is used, which provides us with a comparatively large sample volume. This reduces the exposure times and yields very good diffraction spectra with respect to background. For higher pressures up to 250 Kbar a diamond anvil squeezer is used. Examples are given.