We are using 4.3 GeV Synchrotron radiation from the DESY in Hamburg for energy dispersive X-ray diffraction of samples under pressure and temperature in the range up to 250 Kbar and 400 °C. 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 and peak to background ratio. For higher pressures up to 250 Kbar a diamond anvil squeezer is used.

For NaCl a fair spectrum with 5 distinguishable peaks can be recorded in 1 sec. With an exposure time of 100 sec good spectra are obtained. This fast sequence of recording has been applied to study the compressibility and the time dependence of the phase transition of XCI at 19 Kbar from a NaCl-type to a CsCl-type structure. This transition has been found to be sluggish.

Other topics of research are concerned with the compressibility of FeO, of XCI, and of MnSO4. Or the phase diagram and the decomposition of CuFeS2 under quasi-hydrostatic pressure conditions into FeS, FeS2 and CuSFe.

In the diamond anvil squeezer exposure times of 5 to 10 minutes are required. This compares to about 8 to 10 hours with the white radiation from a tungsten X-ray tube, or even 100 hours with Mo-Kα radiation when using a flat film behind the squeezer.

A method for diffuse scattering measurement by X-ray energy-dispersive diffractometry was developed which permits the study of short-range ordering in disordered binary alloys.

An analysis of the short-range order (S.R.O.) in disordered Au44M alloy was examined, in which we employed a computer-controlled four-circle X-ray diffractometer with the solid state detector (pure Ge) installed to the ultra high intensity X-ray generator (80-15000) of Nagoya University. The scattering angle was set at 18 degrees and the white X-rays in an energy range from 23 to 45 KeV were used. By analysing the intensity data on the basis of a least squares fitting method, S.R.O. parameters up to the 50th shell were determined. They are in good agreement with those obtained by the standard technique proposed by Borie and Sparks (Furuno et al., Z. Metallkde. 71 (1980), 403).

This may imply that the present method is really available in this field of study, using synchrotron radiation. There are, however, a few restrictions in setting up the instrument in order to obtain better resolution, eliminating the fluorescent radiation from the sample; both the resolution and the elimination of the fluorescent radiation depend on scattering angle.

Circularly polarized radiation interacts with unpaired spin electrons through the Compton cross section to yield information about the momentum distribution of magnetic systems. Previous exploratory measurements have been restricted to the use of very weak radioactive sources, however, synchrotrons are potentially strong sources of circularly polarized radiation. The angular distribution of polarized components at 1.5, 1.0 and 0.5 Å have been calculated specifically for the SRS at Daresbury Laboratory. From the relative contributions of each component it has been possible to determine the flux in a beam containing 80% circularly polarized synchrotron radiation for a typical experimental configuration. We conclude that sufficient flux is available on synchrotron sources currently under development for Compton studies on magnetic systems to be feasible.