16. X–11 APPLICATIONS OF X-RAY AREA DETECTORS. By U.W. Arndt, M.R.C. Laboratory of Molecular Biology, Hills Road, Cambridge, CB2 2QH.

The characteristics of area detectors which decide their suitability for a given application are

1. Image size
2. Resolution, ie useful number of pixels parallel to each edge.
3. Maximum total counting rate, a) per pixel b) integrated over the entire area.
4. Time resolution, for time-slide applications.
5. Stability.
6. Detective quantum efficiency
7. Proportionally of response to incident intensity.
8. Energy discrimination.

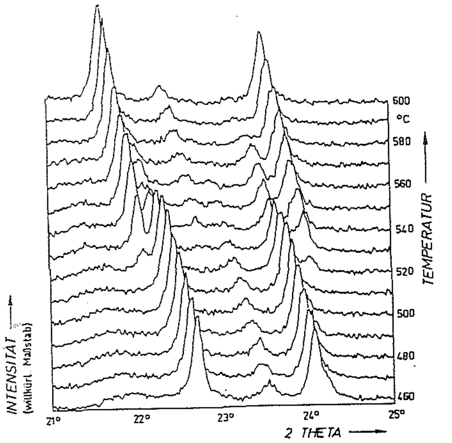
The importance of these characteristics will be discussed in different applications, at conventional and at synchrotron radiation sources, namely

a. Single-crystal structure determination.
b. Diffraction from fibres, solutions and gels.
c. Crystal orientation determination.
d. Topography
e. X-ray microscopy

16. X–12 APPLICATION OF POSITION-SENSITIVE DETECTORS TO CRYSTAL CHEMISTRY. By H.E. Göbel, Siemens Research Laboratories, Munich, FRG.

Position-sensitive proportional counters for X-ray diffraction measurements combine the advantages of photographic film recording (i.e. simultaneous observation over an extended angular range) and single quantum counter detection (i.e. direct electronic pulse and data processing). This can be utilized for rapid data accumulation (H.E. Göbel, Adv. in X-Ray Analysis 22 (1979) 255 or 24 (1981) 123) that reduces the scan time necessary for a complete powder pattern of high quality to less than one minute. Guinier-type transmission patterns of highest quality can be collected in a few minutes (H.E. Göbel, Adv. in X-Ray Anal. 25 (1982) 315). The high speed and quality of data make position-sensitive detectors predestined for the in-situ observation of solid-state reactions, recrystallization phenomena, phase transformations and other crystal-chemical processes. The kinetics of these processes can be traced without a time delay by electronic switching of data storage ranges using a multiplex range addressing (H.E. Göbel, Adv. in X-Ray Anal. 24 (1981) 187). The time resolution, being a matter of counting statistics required for well plottable patterns, ranges between a few seconds for irreversible processes and a few nanoseconds for infinitely reversible phenomena, such as elastic strain deformations.

The paper concentrates on time-resolved high-temperature powder diffraction studies and shows examples of reactions, recrystallization and solution phenomena in glass-ceramic systems and in thin films, as well as phase transformations in perowskites and other oxide materials. The time-resolved diffraction studies revealed information on the crystal-chemical reaction mechanisms and yield thermodynamic parameters such as activation energies, time constants, orders of transformation etc. Detailed interpretations of such studies performed on our systems are presented in three poster contributions at this meeting by E. Rodek et al., W. Rußwurm et al. and G. Zorn.



Transition range of a first-order displacive phase transformation in monoclinic $LiFeGe_2O_6$ (sample from Behruzi, see single-crystal contribution at this meeting)

16. X–13 HIGH PRESSURE RESEARCH WITH SYNCHROTRON RADIATION; RESEARCH IN EUROPE. By B. Buras, European Synchrotron Radiation Project, c/o CERN, CH-1211 GENEVA 23.

Modern electron (positron) storage rings are able to emit very intense X-ray radiation with a continuous spectrum extending from soft to hard X-rays up to 0.1 Å, from bending magnets and insertion devices (wavelength shifters and multipole wigglers). It can be used directly for white beam experiments and/or - for monochromatic beam experiments with wavelength chosen at will from the continuous spectrum. Another type of insertion device, called undulator produces quasi-monochromatic radiation. The insertion devices enable the tailoring of the emitted S.R. to the requirements of the users and can be treated as the first optical element of the beam line.

This feature is especially important for experiments with samples in high pressure cells because the latter imposes limitations both on scattering and absorption experiments. The main limitations are : (i) absorption of the incident and outgoing beam, (ii) limitation in the scattering angle (for diffraction experiments), and (iii) the small cross-section and the small volume of the sample. However these limitations can be minimised in each case by finding the best match between the design of the pressure cell, the experimental method used, and the X-ray beam tailored to the experiment with respect to wavelength, intensity, cross-section, divergence and polarisation. The tailoring of the X-ray beam will be discussed in some detail.

Finally a brief review on high pressure research with synchrotron radiation in Europe will be given.