Textures and Microstructures
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PREFACE

Hard X-rays with photon energies in the range of ~ 100 keV and higher, generated by X-ray tubes, have found very broad application in medicine as well as in non-destructive testing of materials (materials "coarse structure" analysis). They were, however, virtually not used for X-ray diffraction, i.e. materials "fine structure" analysis. Recently, hard X-rays have become available from synchrotron sources in special high-energy wiggler beam lines. These X-rays have much higher intensities and very low angular divergence which makes them suitable for diffraction experiments with wavelengths in the range of ~ 0.1Å. This is an order of magnitude shorter than those of the "characteristic" wavelengths used traditionally for diffraction experiments. Hard X-rays have penetration depths in matter in the centimeter range comparable with those of neutrons. At the same time, however, their angular divergence is smaller than that of neutrons by several orders of magnitude and their intensity is much higher. This makes hard synchrotron X-rays an excellent tool for non-destructive, diffractional materials analysis including, for instance, texture and microstructure analysis, stress-strain analysis, phase analysis, and others. The very high lateral as well as orientation resolving power is particularly advantageous for the study of basic materials phenomena with highest possible resolution. The high penetration depth, on the other hand, makes them an excellent tool for non-destructive investigation and testing of big, technological samples or even complex structural parts of machinery, including on-line investigations.

A workshop on hard synchrotron X-rays for texture and strain analysis was organized at HASYLAB/DESY in Hamburg in April 2003. Its purpose was to bring together physicists, crystallographers and materials scientists working on hard synchrotron X-rays, with potential users of this technique. The workshop combined invited review lectures, submitted papers, and short workshop notes on a broad variety of topics. The proceedings, presented here, provide a good survey of the actual state of the art of the available techniques as well as potential fields of application for these techniques in basic research and technology.

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