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3D-Microstructure Investigations Using Microbeams

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3D-Microstructure Investigations Using Microbeams

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The availability of high brilliance synchrotron x-ray sources and new high-precision x-ray focusing optics have made possible revolutionary advances in microbeam x-ray capabilities for the investigation of materials on mesoscopic length scales of tenths of microns to hundreds of microns. This paper will discuss the generation of submicron resolution polychromatic x-ray microbeams using Kirkpatrick-Baez mirrors and the application of interchangeable polychromatic/monochromatic microbeams in connection with interactive Laue diffraction analysis software for the investigation of the orientation, spatial distribution, and stress/strain in 2-D and 3-D polycrystalline and deformed materials. Recent results using a new technique to achieve submicron depth resolution will be presented. Examples will include investigation of inter- and intra-granular strain and orientation in aluminum interconnect wires and the deformation microstructure under nanoindents in copper and a plane-strain deformed aluminum tri-crystal. The techniques and analyses used to obtain submicron beams and submicron 3-D spatial resolution will be discussed.

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