Mechanisms of Cyclic Deformation

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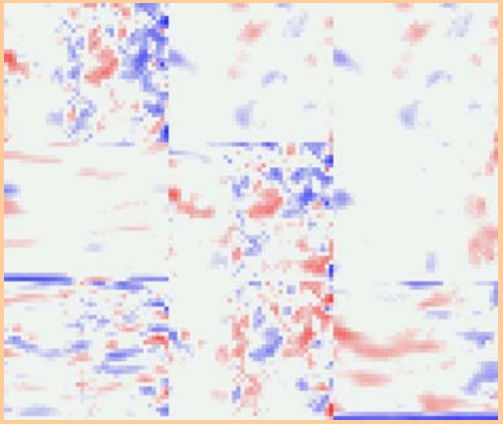
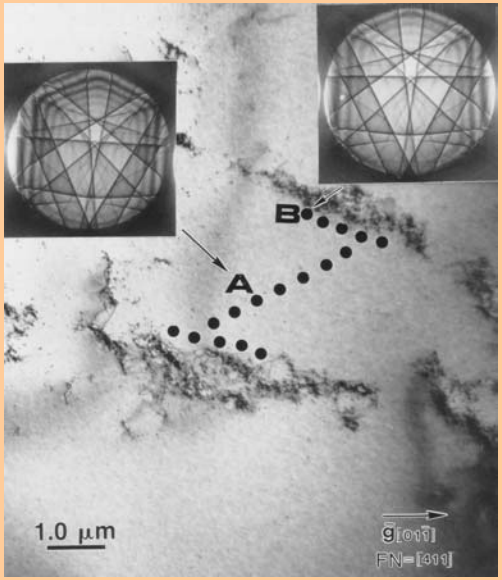
Graphical representation of dislocation tensor, (obtained from new microbeam technique), which contains local strain data from which internal stresses may be calculated. (unpublished, 2004, from collaboration with Ben Larson, ORNL / APS)





Thin foil assessment of local internal stress state by measuring local lattice parameter via CBED. (Kassner M.E., Perez-Prado M.-T., Vecchio K.S., Wall M.A., *Acta Metall.*, 2000)

A long standing question in materials science relates to the existence of "Long Range Internal Stresses" and their use in explaining specific mechanical behaviors. Previous attempts to measure these stresses have primarily relied on analyses of thin foils of deformed metals. Recent technological development of an x-ray microbeam technique has the capability of directly measuring these local stresses on bulk samples. This is an unprecedented capability and opportunity to resolve a fundamental question in materials science.

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Broader Impacts:

This research has supported one undergraduate student, Joe Lemberg from Cornell, for a summer while studying micro - diffraction and the existence of long-range internal stresses (LRIS).

Presently, this research is the PhD dissertation topic of two USC graduate students. Michael Delos - Reyes is continuing the LRIS study with an emphasis on x-ray line profile asymmetry. Henry Gao is presently continuing the microbeam diffraction aspects, in collaboration with Ben Larson (ORNL), and Argonne National Laboratory.