13.5-2 RESIDUAL STRESS - A COMPARATIVE STUDY USING NEUTRONS, X-RAYS, AND FINITE ELEMENT ANALYSIS.

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In polycrystalline materials, average changes in lattice spacing can be detected by displacements of the Bragg peaks observed by both x-ray and neutron diffraction. With a knowledge of the appropriate elastic constants and the shift in the peak position as a function of sample rotation (about an axis normal to the plane of diffraction), the stress in a particular direction can be calculated.

The sample designed for this study was a steel disk in which a plug had been shrunk-fit into a hole cut in the centre of the disk at an angle of 15 degrees to the surface normal.

The resultant stress tensor in the plug was evaluated by modelling the interference between the plug and the plate using finite element methods. This tensor was then compared with the tensor evaluated from stress component measurements made using each of the diffraction techniques. The analyses of Noyan (Noyan, I.C. Met. Trans., 1983, 14, 249 - 258) and Sasaki (Sasaki, T., Kuramoto, M., Yoshioka, Y. Adv. X-ray Anal., 1984, 27, 121 - 128) have been applied in order to evaluate the complete stress tensor from a sufficient number of component directions and measurements from additional directions used as consistency checks.

The comparison between the direct measurements and the results of the finite element calculation will be discussed.