

Residual Stress Facilities at ORNL

X-ray, Synchrotron, and Neutron Diffraction

Summary

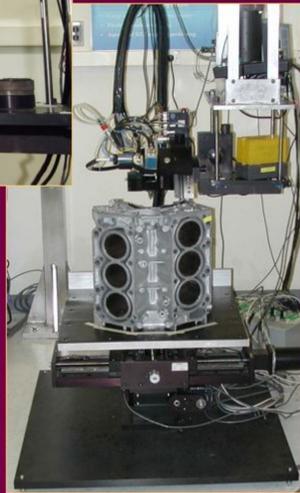
The Residual Stress User Center assists academic and industrial users to characterize the macro and micro residual stresses in materials and systems. The facilities primarily utilize laboratory x-ray, synchrotron x-ray, and neutron diffraction methods and are complemented by strain gauging, electropolishing, coordinate measurement machine, x-ray furnaces, and micro Raman systems.

Recent upgrades of the large specimen x-ray and neutron diffraction mapping systems aim to achieve an order of magnitude improvement in capabilities and speed. These systems permit automated surface and through thickness residual stress mapping on small research and large industrial specimens. The high-flux, parallel beam synchrotron beam line X14A at NSLS is particularly valuable for measurement of stress on highly curved specimens and for grazing incidence studies. Two 4-axis diffractometers, one coupled with a rotating anode generator and multilayer x-ray optics, provide additional capabilities for laboratory based measurements.

X-ray Residual Stress Mapping



- ❖ Two XYZ ϕ stages
- ❖ Small to very large samples
- ❖ Engineering measurements
- ❖ Fully automated



Monochromator as installed in HB-2 shielding tunnel

Neutron Residual Stress Mapping

- ❖ 2nd generation instrument
- ❖ New, doubly focusing, 4 wavelength monochromator
- ❖ Large capacity XYZ Ω goniometer (250 Kg)
- ❖ Kappa goniometer for strain tensor studies (5 Kg)
- ❖ Fully automated
- ❖ Load frame



PTS Rotating Anode

- ❖ High flux, parallel beam optics
- ❖ 4-Axis goniometer for ψ and χ tilts
- ❖ Grazing incidence



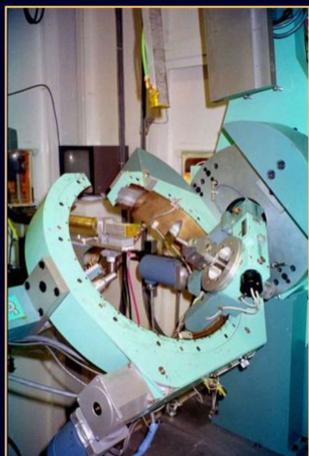
PTS Tube

- ❖ 4-Axis goniometer for ψ and χ tilts
- ❖ Multiple wavelengths
- ❖ Retained austenite
- ❖ Texture measurements



PANalytical X'PERT Pro MPD

- ❖ Bragg-Bentano and parallel beam optics
- ❖ Anton Paar hot stages
- ❖ HT residual stress



X14A Synchrotron Beamline at NSLS

- ❖ Very high flux, parallel beam
- ❖ Monochromatic x-rays
- ❖ Wavelength tuneable: 3-26 keV

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Acknowledgements

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