



# Non-Destructive Evaluation of Sub-Surface Residual Stress Produced by Surface-Treatment Techniques



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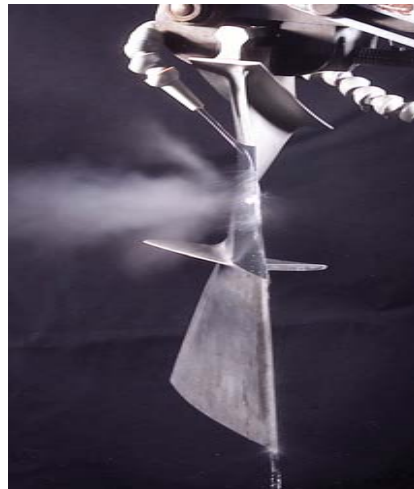
**Department of Aerospace Engineering and Engineering Mechanics**

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**Shot Peening (SP)**



**Laser Shock Peening (LSP)**



**Low-Plasticity Burnishing (LPB)**



# XRD Measurements on Shot-Peened Waspaloy Specimens

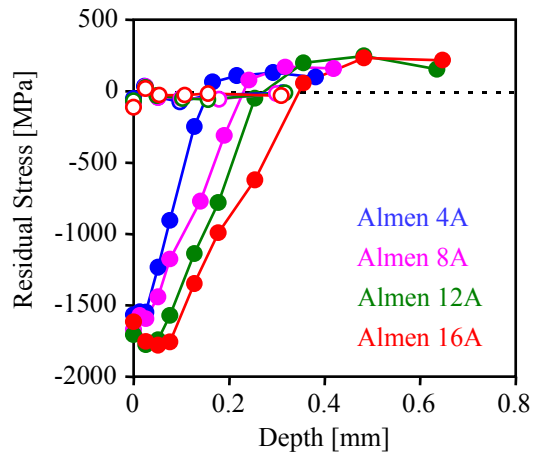


**XRD Main Challenges:**

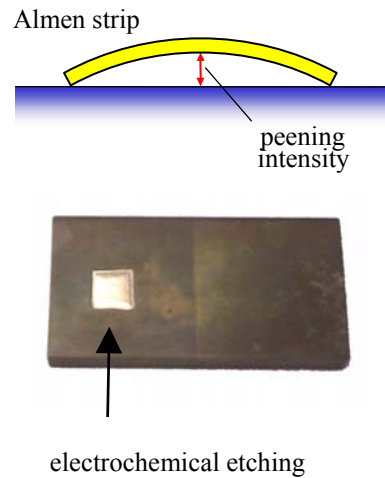
- low penetration depth ( $\approx 1-10 \mu\text{m}$ )
- steep stress gradient

**Synchrotron Radiation and Neutron Diffraction**

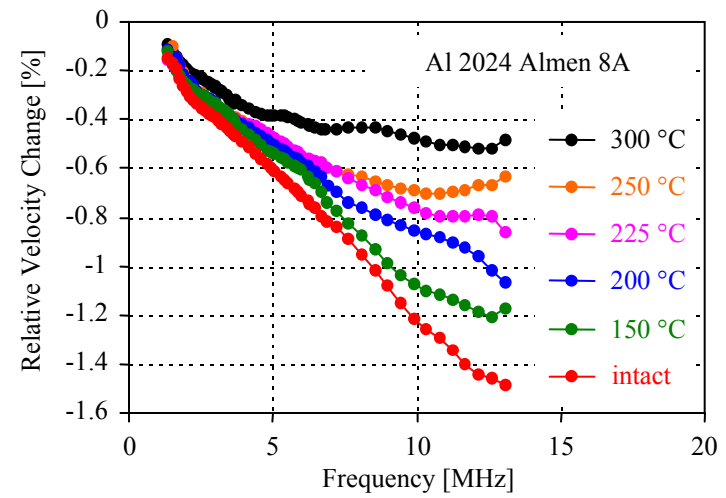
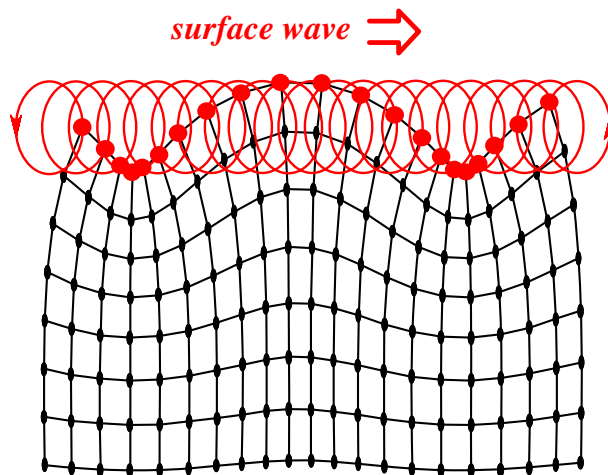
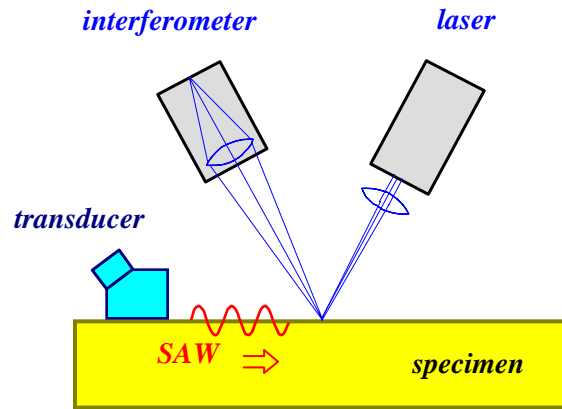
- good penetration depth ( $\approx 1-5 \text{ cm}$ )
- availability of source is questionable



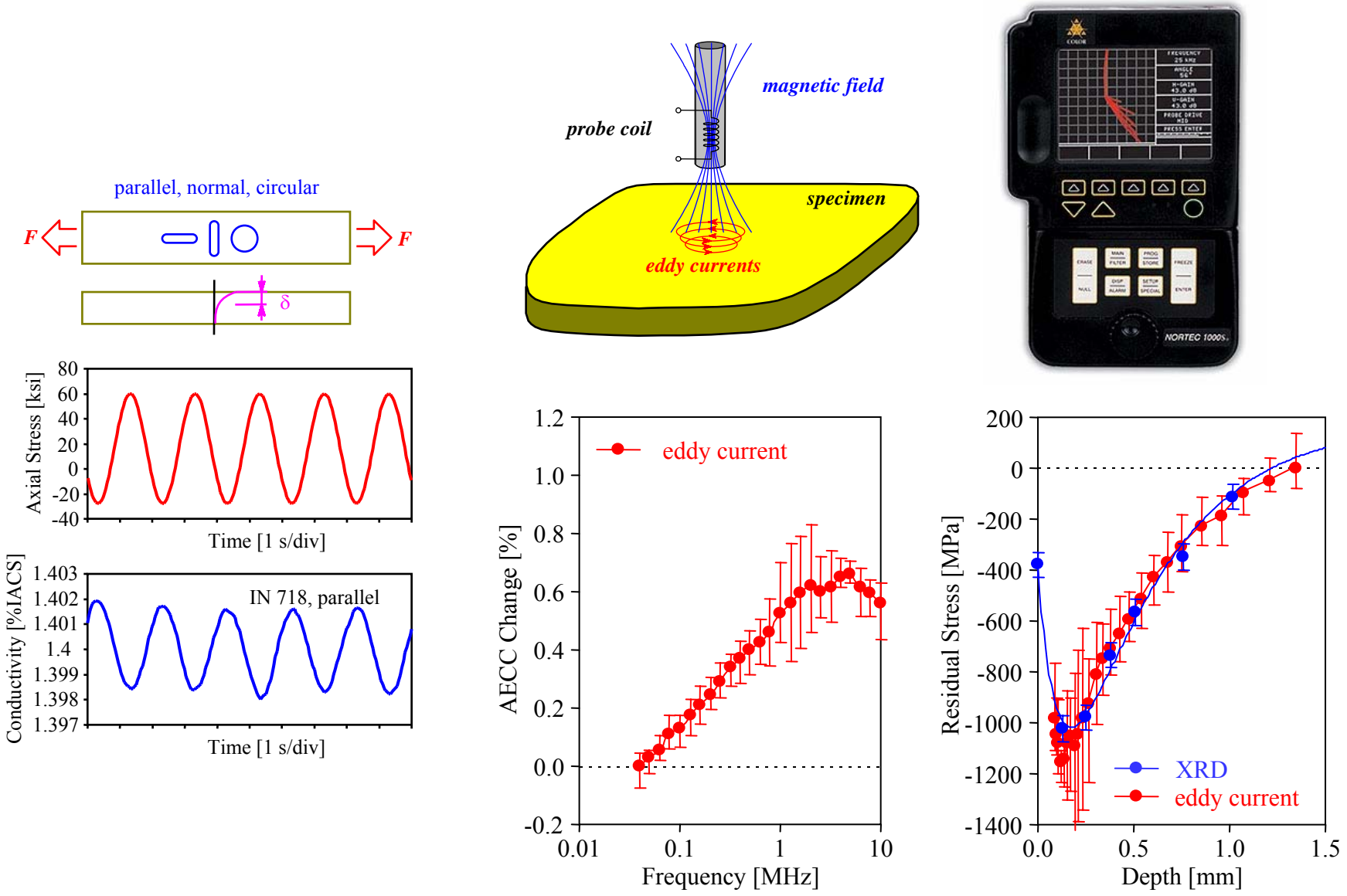
Waspaloy before (solid circles) and after annealing (empty circles) at 900 °C, 24 hrs



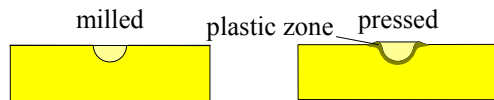
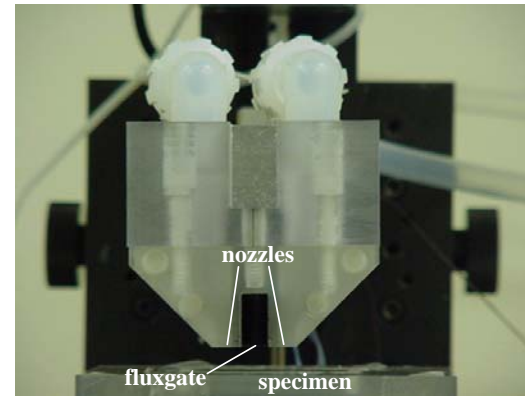
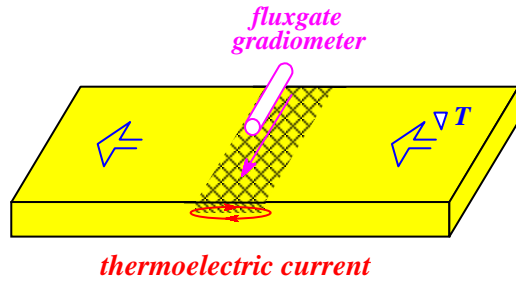
# Ultrasonic Near-Surface Residual Stress Assessment



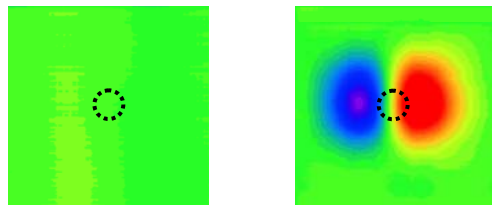
# Eddy Current Near-Surface Residual Stress Assessment



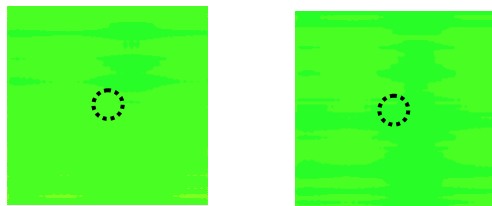
# Thermoelectric Near-Surface Residual Stress Assessment



0.375"-diameter cavity, 18 nT<sub>p</sub>



before annealing



after annealing

