X-ray diffraction residual stress measurement

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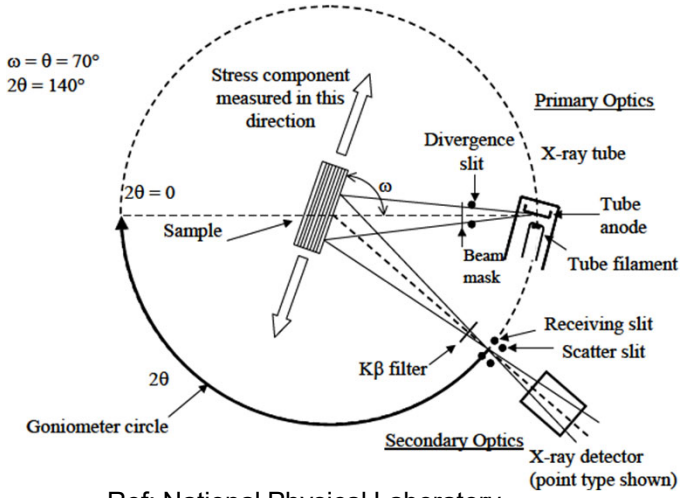
X-ray diffraction overview

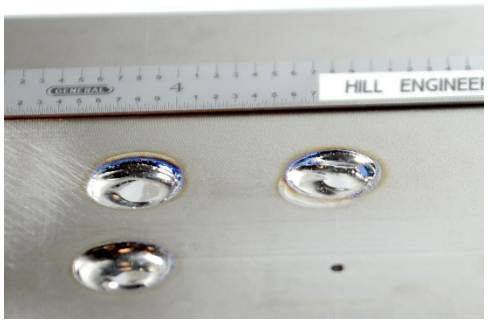
X-ray diffraction (XRD) is a technique for determination of near-surface residual stress. The method can be combined with layer removal to generate a residual stress profile to a depth of 1.0 mm. X-ray diffraction is typically performed in the laboratory but can be applied in the field.

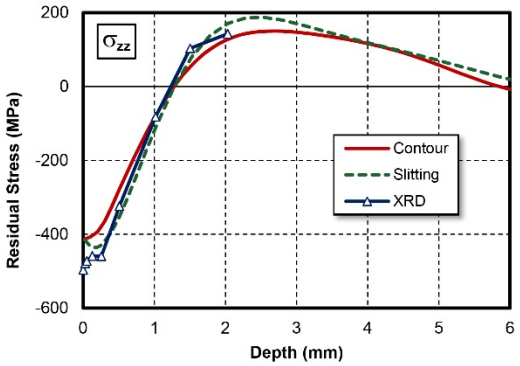
The lattice spacing of a material changes due to the presence of residual stress – tensile residual stresses will increase the lattice spacing and vice versa. XRD uses the diffraction pattern observed when a polycrystalline material is irradiated with an X-ray beam to measure the lattice spacing.

X-ray diffraction is realized by penetrating a specimen with a focused x-ray beam at a measurement site and measuring the strain in the crystal lattice. Layer removal is used to measure residual stress at depths beyond the penetration distance. The residual stress is determined assuming a linear elastic distortion of the crystal lattice plane.



Ref: National Physical Laboratory





X-ray diffraction applications

X-ray diffraction is well-suited for a wide range of conditions. The following are examples where x-ray diffraction excels:

- Quantification of near-surface residual stress (to a depth of 1.0 mm)
- In-field measurements using portable equipment
- Multiple residual stress components (in-plane principal stresses)

Why Hill Engineering?

Hill Engineering has a reputation for providing high-quality residual stress measurement data suitable for engineering analysis. Our in-house laboratory performs residual stress measurements using a variety of techniques to meet the needs of industry.

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