X-ray diffraction residual stress measurement

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 (typically 0.025 mm penetration distance). 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.

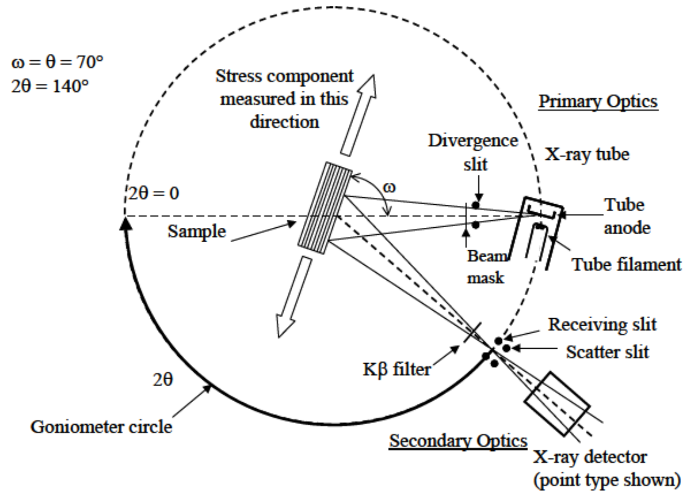
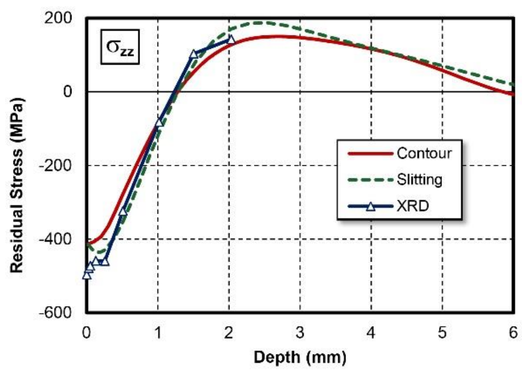


Figure provided by the National Physical Laboratory



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.

Contact information

sales@hill-engineering.com
+1 (916) 635-5706
hill-engineering.com