

CORRECTIONS IN X-RAY GRAZING INCIDENCE TECHNIQUE USED FOR STRESS MEASUREMENT

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X-ray grazing incidence technique can be used to study samples with important stress gradients. Using this method, it is possible to perform a non-destructive analysis of the heterogeneous stress field for different (and well defined) volumes below the surface of the sample. Moreover, the stress can be measured at very small depths, of the order of a few μm . Asymmetric geometry is used in this technique. The penetration depth of radiation is almost constant in a wide 2θ range for a given incidence angle α . It can be easily changed by an appropriate selection of α angle (or also by using a different type of radiation). This enables the investigation of stress variation with depth below the sample surface.

There are, however, some factors which have to be corrected in this technique. The most important is the refraction of X-ray wave (with refraction coefficient smaller than one): it changes the wave length and direction of the beam inside a sample. These two effects cause some shift of a peak position and they have to be taken into account in data treatment. For small incidence angles ($\alpha \leq 10^0$) the corrections are significant and can modify the measured stress even of 70 MPa. The refraction correction decreases, however, with increasing the incidence angle. Other corrections (absorption, atomic factor, Lorentz-polarization factor) are less important for the final results.

The studied corrections were tested on three reference ferrite powder samples with different FWHM and on a sample of AISI316L stainless steel.