

X-RAY STRESS MEASUREMENT OF NICKEL-BASE SINGLE CRYSTAL SUPERALLOY USING TWO-DIMENSIONAL DETECTOR

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The stress in a single crystal of nickel-base superalloy with 72% volume fraction of γ' -phase was measured by the X-ray method. The specimen whose surface normal was parallel to [001] direction was oscillated around ϕ -axis during recording of the X-ray diffraction pattern with a two-dimensional position sensitive proportional counter (PSPC). The stress was determined from the measured strain using the multiple regression method and the two-tilt method.

The uniaxial stress was applied along [100] direction and the stresses were measured with the X-ray methods. The stress along [100] direction, σ_{11} , measured with the X-ray method increased proportionally to the applied uniaxial stress, and the measured stress was about 5 % smaller than the applied stress. The other stress components, σ_{22} and σ_{12} , did not change with the applied stress. With respect to the machined surface, the residual stress was a compression of about 700 MPa on the surface and abruptly decreased to zero at about 15 μ m beneath the surface. The increase in the full-width at half maximum was observed within the depth of about 15 μ m from the machined surface.