Residual stress analysis in cubic textured polycrystalline materials by XRD

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Biaxial residual stress, σ_{11}, σ_{22} and σ_{12}, in a cubic polycrystalline material TiN with <111> fibre texture obtained by sputtering Ti on a polyamide film substrate in N_2 atmosphere, was analyzed by the accurate measurement of strains by X-ray diffraction (XRD) on the basis of a treatment given by Yokoyama and Harada (2009), hereinafter referred as Y&H, in which the stress model of Reuss was utilized for a cubic specimen with the Laue class $m\bar{3}m$. According to Y&H, the strains, which are evaluated from Bragg angles observed at several different measurement directions, can be represented as a linear function with stress components. Thus, in the present analysis, a least-squares refinement, LSR, method was applied to obtain the stress components by fitting the strains observed with the calculations based on Y&H, where the strains observed were estimated from the accurate measurement of several Bragg angles by assuming the lattice parameter under stress free state. As the lattice parameter under stress free state is not known because of non-stoichiometry of $Ti_{1-x}N_x$,

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