

## X-RAY STRESS MEASUREMENT OF SURFACE THIN LAYER BY MEANS OF EVANESCENT WAVE WITH IN-PLANE DIFFRACTION

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This study is about the x-ray stress measurement for determining stresses in surface thin layer of the material by means of the evanescent wave. This method utilizes the element of x-rays (evanescent wave) which run within thin layer parallel to the surface of the material when x-ray incident angle is very small and near the glancing angle. These beams can diffract from crystals of which plane normal is parallel to the surface of the material. The penetration depth of this case is an order of nano meters, which is the similar level as the method using electrons, photons and auger electrons. So the strains in these thin layers of the material can be obtained from these diffraction beams. These measurement can be made with the grazing incidence in-plane diffractometer which has been developed by one of the authors for the purpose of the evaluation of the surface of thin films. And the purpose of the present study is to develop a new method of the stress analysis in surface thin layer of nano meter order of the material utilizing this system. First, a new method for the stress calculation was developed for this new type of diffractometer, which is based on the  $\theta$  angle method in order to keep the constant penetration depth during the measurement. The depth profile of the stress in the direction of the depth can be also evaluated from data obtained from the different penetration depth, which can be changed by the x-ray incidence angle.

An experiment was made as its practical application using Cu-K $\alpha$  radiation and a copper plate specimen which was polished. The Cu 311 diffraction was adopted. The x-ray incident angles ranged from  $\alpha = 0.4$  to 0.8 (deg) was selected, for which the penetration depth was ranged from 0.34 to 0.68 (nm). The results were compared to the data which were obtained using the ordinary diffraction condition such as  $\alpha = 30$  to 90 (deg,  $\gamma = 60$  to 0 deg).

