

X-RAY IN-SITU RESIDUAL STRESS MEASUREMENT OF FIBER REINFORCED PLASTIC COMPOSITE.

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Recently, the importance of fiber reinforced composite materials (FRP) are increasing with the explosion of applications due to development of new materials in industrial fields. The stress estimation of FRP is expected and needs to establish the reliable measurement method under there background. In this study, the residual stresses in FRP samples were examined by X-ray stress measurement technique. These FRP samples were manufactured from high density polyethylene (HDPE) matrix and tungsten reinforced fibers. There are few report of residual stress investigation in macromolecule materials by using the X-ray stress measurement with typical reflection method. The two kinds of reason exist in these situations, one is the diffraction peaks from macromolecule appear on 2θ low angle region. The accuracy of strain measurement is reduced in such case. Another is the problem of ψ angle width in $\sin^2\psi$ method. If diffraction peak appear in 2θ low angle, ψ offset angle is restricted seriously. To solve these problems, transmission method was employed for residual stress measurement of HDPE composite as the new trial in this study. In actual experiment, the small tensile testing machine was mounted on the X-ray diffractometer. After following preparation of tensile system, alternation of peak positions were measured under the several applied stresses. From these results, 2θ - $\sin^2\psi$ diagram expressed the good linearity on regression line of the measurement data, and gradients of regression line correspond to applied stress levels. Furthermore, the in-situ thermal stress measurement was performed at several temperatures. the small furnace mounted on the diffractometer was used, and temperature was change from R.T. to 60°C. Thermal residual stresses in HDPE matrix changed to compressive state with temperature rising. The other hand, in the case of decreasing temperature stage, thermal residual stresses shifted to tensile residual stress states.

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