

STUDY OF COMPUTERIZED TOMOGRAPHY AND STRAIN MAPPING IN THE VICINITY OF CRACK TIP IN STEEL MATERIAL USING SYNCHROTRON WHITE X-RAY

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A computerized tomography and a strain mapping in the vicinity of a crack tip in steel were investigated using a high energy white X-ray obtained from BL28B2 beam line at SPring-8 in Japan. Low-alloy and high-tensile steel (JIS G3128 SHY685) was used as a specimen prepared in the cylindrical geometry. A fatigue crack was introduced into the specimen by a cyclic loading. The computerized tomography of the crack in the specimen was carried out by using the X-ray CCD camera that can detect the X-ray transmitted through the specimen. To measure the strain, the synchrotron white X-ray beam, which had a height of 100 μ m and a width of 100 μ m, was incident on the specimen with the Bragg angle θ of 5 degrees using the energy dispersive X-ray diffraction technique. The internal strain in the vicinity of the crack tip was mapped out by scanning the irradiated X-ray position around it.

As the results, the computerized tomography of the crack in the specimen under the loading of crack opening was practicable by using the synchrotron white X-ray [Fig.1]. The contour map of the internal strain near the crack tip of the steel of 5mm diameter could be obtained using the white X-ray with energy ranging from 50keV to 150keV [Fig.2]. It was confirmed that the synchrotron white X-ray is useful for the computerized tomography of the internal crack and the strain mapping near it.

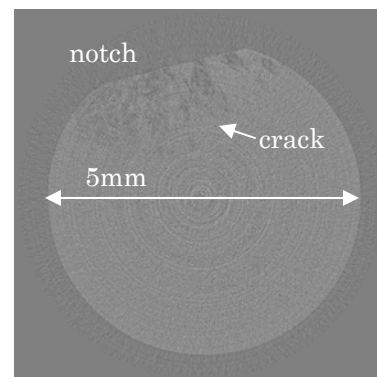


Fig. 1 X-ray CT image of internal crack

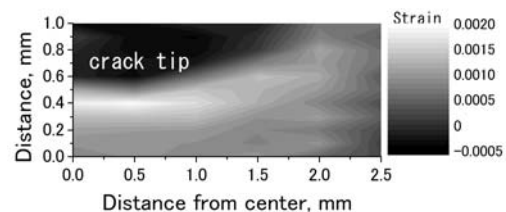


Fig. 2 Contour map of the strain in the vicinity of the internal crack tip