DETECTION OF DAMAGE EVOLUTION IN SIC/SIC UNDER TENSILE LOADING USING TALBOT-LAU X-RAY INTERFEROMETER

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Key Words: Nondestructive evaluation, SiC/SiC composites, In-situ observation, Talbot-Lau interferometer, Matrix cracking

There are various types of defects in Ceramic matrix composites (CMCs) may occur within different locations at various levels of scale due to different manufacturing process. Nondestructive evaluation (NDE) techniques to detect such defects had been demonstrated effectiveness in reliability assurance throughout the whole CMCs including manufacturing defect inspection and the in-service damage. It is important to understand damage accumulation processes such as matrix cracking initiation and evolution in CMCs during loading. X-ray microtomography (μCT) conducted using synchrotron radiation with high resolution has been used to observe such micro-cracking initiation and propagation coupled with in-situ mechanical testing to understand damage mechanisms in CMCs. It is difficult to observe a large field of view in a short time. Nowadays, X-ray Talbot-Lau interferometry equipment has been developed for detecting such micro-cracking and damage evolution by using three characteristic images obtained attenuation contrast (AC), differential phase contrast (DPC), and small scattering contrast (SSC). In the present study, in-situ damage evolution for unidirectional SiC fiber reinforced SiC matrix composites (SiC/SiC composites) fabricated by melt infiltration processing is investigated using Talbot-Lau interferometer. The micro-cracking initiated in the matrix was clearly observed using SSC images at stress level below proportional limit and the matrix-cracks was increased with increasing loading. The evaluation of defects after processing and damage evolution will be discussed to understand fracture mechanisms. The effectiveness of damage detection in CMCs using Talbot-Lau interferometer will be verified by comparing using X-ray micro focus X-ray CT.

This work was supported by Council for Science, Technology and Innovation (CSTI), Cross-ministerial Strategic Innovation Promotion Program (SIP), “Materials Integration for revolutionary design system of structural materials ”(Funding agency :JST), and was partially based on results obtained from a project, JPNP20005, commissioned by the New Energy and Industrial Technology Development Organization (NEDO).