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USE OF X-RAY TOMOGRAPHIC MICROSCOPY TO STUDY DUCTILE FRACTURE,

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X-ray tomographic microscopy (XTM) is a promising technique to investigate ductile fracture because voids formed under conditions of high triaxiality can be directly observed nondestructively. In this experiment, ultrahigh vacuum diffusion bonding has been used to make model specimens in the Al/sapphire system. Samples were prepared in the 4-point bend geometry with notch. XTM images acquired after several loadings of the sample revealed the morphology of the growing voids. The primary findings are that (i) damage ahead of the notch initiates by interface debonding at a location coinciding with maxima in triaxiality and tensile traction at the interface, (ii) debonding occurs at the most early stages in the observation of plasticity, (iii) the debond expands for a limited distance, likely arresting due to crack tip blunting, (iv) this lenticular debond then becomes spherical with further strain and (v) intergrowth of the spherical voids leads to the typical ductile rupture fracture surfaces observed in this system.

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