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Fundamental considerations in dynamic fracture in nuclear materials CARL CADY, Los Alamos National Laboratory, DAVID EASTWOOD, NEIL BOURNE, RUIZHI PEI, PAUL MUMMERY, University of Manchester, CHRISTOPH RAU, Diamond Light Source — The structural integrity of components used in nuclear power plants is the biggest concern of operators. A diverse range of materials, loading, prior histories and environmental conditions, leads to a complex operating environment. An experimental technique has been developed to characterize brittle materials and using linear elastic fracture mechanics, has given accurate measurements of the fracture toughness of materials. X-ray measurements were used to track the crack front as a function of loading parameters as well as determine the crack surface area as loads increased. This X-ray tomographic study of dynamic fracture in beryllium indicates the onset of damage within the target as load is increased. Similarly, measurements on nuclear graphite were conducted to evaluate the technique. This new, quantitative information obtained using the X-ray techniques has shown application in other materials. These materials exhibited a range of brittle and ductile responses that will test our modelling schemes for fracture. Further visualization of crack front advance and the correlated strain fields that are generated during the experiment for the two distinct deformation processes provide a vital step in validating new multiscale predicative modelling.

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