Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Advances on mode I fracture testing in brittle and quasi-brittle materials with x-ray tomography ANTOINE CORNET, DAVID EASTWOOD, NEIL BOURNE, PAUL MUMMERY, University of Manchester, CARL CADY, Los Alamos National Laboratory, CHRISTOPH RAU, Diamond Light Source — In the framework of development, testing and commissioning of new materials for fourth generation fission power plants and future fusion power plants, a special sample geometry has been developed in the past few years to become a benchmark test to study mode I fracture in brittle materials. The specific requirements this geometry fulfil are the development and control of a stable crack, a scalable nature to allow probing of sample of different sizes, and simplicity in sample preparation. However, the calculation of Linear Elastic Fracture Mechanics solutions are no more valid when new mechanisms for energy dissipation are present, which prevents the derivation already developed to be used for quasi-brittle materials. To overcome this dead end and derive quantitative measurements of energy dissipation, we applied 4D x-ray tomography and gathered a dedicated numerical toolbox. In particular, we derived J-integrals values and strain fields to allow further comparison with modelling results. We will demonstrate the effectiveness of this process through some examples in nuclear graphite and explosive-like composite. Finally, we will show that the simplicity of the specimen geometry allows complex sample environment, opening the possibility to work on toxic or radioactive materials.

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Date submitted: 02 Mar 2019 Electronic form version 1.4