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Mode I crack propagation in homogeneous nuclear graphite (symp.) ANTOINE CORNET, DAVID EASTWOOD, NEIL BOURNE, PAUL MUMMERY, University of Manchester, CARL CADY, Los Alamos National Laboratory, CHRISTOPH RAU, Diamond Light Source — Because of its unique properties, graphite serves as a structural component and neutron moderator in nuclear reactor for over 40 years, and should continue to play this role in the upcoming fourth generation of power plant. In nuclear graphite, it is known that the strength depends on the length scale probed, and therefore with the level of defect or structure associated. Indeed, the crack path is strongly dependent on the precursor particle shape and density. Thus, nuclear graphite with limited heterogeneity represents an appealing lead to higher performance material. With 4D tomography, we analysed in-situ under load the development of strains in a homogenous graphite during the initiation and the development of a mode I fracture. The structure of this graphite grade (Mersen 2020), consists of a percolating network of porosity channel of about 20 μm in diameter, with an average grain size of 15 μm, to be compared to the 2 mm precursor particles in PGA and Gilsocarbon graphite. Assessment of this homogeneous grade is done relatively to Gilscarbon graphite on two relevant quantities: the extension of the process zone, i.e. the plastically deforming zone that will later form the crack tip, and J-integrals, i.e. the quantification of the energy dissipated as the crack propagates.

Antoine Cornet
University of Manchester

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