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Intermittency in brittle cracks: Model experiment in artificial rocks JONATHAN BARES, DANIEL BONAMY, CEA, Saclay (CEA/DSM/IRAMIS/SPCSI/LNOCS), DAVY DALMAS, UMR CNRS-Saint Gobain, Aubervilliers, LAMINE HATTALI, CEA, Saclay (CEA/DSM/IRAMIS/SPCSI/LNOCS) — Continuum theory fails to account for disorder effect on the crack propagation in brittle heterogeneous materials: It can explain neither the crackling dynamics, nor the statistics of the macro-scale mechanical observables. In this context, some tools issued from out-of-equilibrium statistical physics that identifies crack propagation onset with a depinning transition appear promising, but lack for quantitative comparisons with experiments. We designed a model experiment set up based on a material with tunable micro-scale (ceramics of sintered polymer beads) in which tensile cracks is grown over a wide range of speeds. Crack length, mechanical energy and acoustic emission (AE) are monitored with good resolution (ms for the first two, μs for AE) during the experiments. These measures were used (i) to provide information on the nature of the acoustic energy emitted during a breaking event, (ii) to unravel the relation between material toughness and relative system size. We believe our experiment to find applications in mechanical engineering, by helping to understand the microstructural disorder effect on the toughness properties. In statistical physics, it provides a model system to study collective complex crackling dynamics. Finally, in geophysics it help to interpret AE signal used to monitor the damage in Earth crust.

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