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Topological interlocking provides stiffness to stochastically microcracked materials beyond the transport percolation limit. ANIRBAN PAL, CATALIN PICU, Department of Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytech Institute, MARIAN V. LUPULESCU, New York State Museum, Research and Collections — We study the mechanical behavior of two-dimensional, stochastically microcracked continua in the range of crack densities close to, and above the transport percolation threshold. We show that these materials retain stiffness up to crack densities much larger than the transport percolation threshold, due to topological interlocking of sample sub-domains. Even with a linear constitutive law for the continuum, the mechanical behavior becomes non-linear in the range of crack densities bounded by the transport and stiffness percolation thresholds. The effect is due to the fractal nature of the fragmentation process and is not linked to the roughness of individual cracks. We associate this behavior to that of itacolumite, a sandstone that exhibits unusual flexibility.

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