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Shock driven jamming and periodic fracture of particulate rafts MAHESH BANDI, SEAS, Harvard Univeristy. CNLS & MPA-10, Los Alamos National Laboratory, TUOMAS TALLINEN, L. MAHADEVAN, SEAS, Harvard University — A tenuous monolayer of hydrophobic particles at the air-water interface often forms a scum or raft. When such a monolayer is disturbed by localized surfactant introduction, a radially divergent shock emanates and packs the particles into a jammed, compact, annular band that grows with time. The resulting two-dimensional, disordered, elastic solid locally has a packing fraction that saturates at random close packed density (ϕ_{RCP}) and fractures as it is driven radially outwards, to form periodic triangular cracks with robust geometrical features. We find that the number of cracks N varies monotonically with the initial particulate packing fraction ϕ_{init}, as does the compaction band radius R^* at fracture onset. However, its width W^* is constant across all ϕ_{init}. A simple geometric theory that treats the compaction band as an elastic annulus, and accounts for mass conservation allows us to deduce that $N \simeq 2\pi R^*/W^* \simeq 4\pi\phi_{RCP}/\phi_{init}$, a result that we experimentally verify over the range $(0.1 \leq \phi_{init} \leq 0.64)$.

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