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Cell refinement and growing misorientations from a continuum dislocation density theory YONG CHEN, WOOSONG CHOI, STEFANOS PAPANIKOLAOU, JAMES P. SETHNA, Laboratory of Atomic and Solid State Physics, Cornell University, SURACHATE LIMKUMNERD, Physics Department, Chulalongkorn University, Bankok, Thailand — At low temperatures, climb-free plastic deformation of crystals usually leads to the formation of cellular dislocation structures. Some experiments show fractal distributions of cell sizes; others show a single (non-fractal) characteristic cell size, but a scaling behavior of lengths and misorientations with external strain as the cellular structure refines. By adding an external growing stress field to a refined variant of our recently proposed wall-forming continuum dislocation dynamics theory [1], we explore the formation and evolution of these cellular structures. We shall search both for the emergence of fractal geometries (in suitable experimental geometries) and for the emergence of scaling behaviors of misorientation angles and cell size distributions.

[1]S. Limkumnerd and J. P. Sethna, Phys. Rev. Letters 96, 095503 (2006)

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