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Fluid-like flows in large-strain deformation of metals HO YEUNG, National Institute of Standards and Technology, DINAKAR SAGAPURAM[1], KOUSHIK VISWANATHAN, Purdue University, NARAYAN SUNDARAM, Indian Institute of Science, ANIRBAN MAHATO, KEVIN TRUMBLE, SRINIVASAN CHANDRASEKAR, Purdue University — Laminar or smooth plastic flow, commonly observed in large deformation of metals, becomes unstable under certain conditions, resulting in inhomogeneous plastic flow. Using *in situ* imaging, we demonstrate the unique features of two inhomogeneous flow modes in metal plasticity — the well-known shear band flow and the recently discovered sinuous flow — and methods for suppressing them. Both modes occur via a two stage process — nucleation and flow development. The nucleation stage results in a weak material zone and the development stage involves imposition of significant strains. In the case of shear bands, using additional micro-marker techniques, we show that the second stage is well described by a viscous slider model. As a result, controlling the second stage causes band formation to cease. We demonstrate the use of this method — Passive Geometric Flow control — to form long strips from metallic alloys that are difficult to form conventionally. For sinuous flow, nucleation and flow formation kinematics show remarkable resemblance with flows in complex fluids. The nucleation stage can be altered using suitable ink coatings on the free surface or by surface pre-straining, and we use this idea to demonstrate complete sinuous flow suppression.

[1]Membership pending

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