Plastic avalanches in curved nanocrystalline shells.

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Abstract: We study the mechanical response of curved crystalline shells subject to load. These structures, mainly conceived for encapsulation purposes at small scales, show peculiar behaviour due to their topological properties, i.e., the minimum energy configuration of any curved crystalline surface contains geometrically necessary topological defects in agreement with its Euler characteristic. The microstructure evolution is therefore influenced by the dynamics of those topological defects on the curved interface and exhibits a rather rich and non-trivial phenomenology. The quasi-static deformation of these structures is characterized by intermittent dynamics in the form of plastic avalanches with collective particle reorganizations mediated by the proliferation of dislocation pairs and the migration/reorientation of grain boundary scars. Our finding suggest that shell curvature introduces particular properties in the statistical behaviour of these plastic avalanches.