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Pattern-wavelength coarsening from topological dynamics in silicon nanofoams

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Abstract— We report the experimental observation of a submicron cellular structure on the surface of silicon targets eroded by an ion plasma. Analysis by atomic force microscopy allows us to assess the time evolution and show that the system can be described quantitatively by the convective Cahn-Hilliard equation, found in the study of domain coarsening for a large class of driven systems. The space-filling trait of the ensuing pattern relates it to evolving foams. Through this connection, we are actually able to derive the coarsening law for the pattern wavelength from the nontrivial topological dynamics of the cellular structure. Thus, the study of the topological properties of patterns in nonvariational spatially extended systems emerges as complementary to morphological approaches to their challenging coarsening properties.

Index Terms—

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