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Nanopatterning of rotating highly oriented pyrolytic graphite (0001) surfaces by ion beam irradiation: experiments and modeling

E. Lee; J. Seo; J. Muñoz García; M. Castro Ponce; R. Cuerno Rejado; J.-S. Kim

Abstract-

We produce ordered surface nanostructures on azimuthally rotating HOPG(0001) by irradiation with low-energy ion beams. Thus, small dots at low fluences evolve into cellular structures at large fluences. This transition is a consequence of the fast growth of dots and their subsequent concatenation to form walls along the grain boundaries, leading to cells. The walls compete and ripen with continued ion beam irradiation, resulting in both coarsening and roughening of the cell pattern. We reproduce the same morphological and scaling behavior using different ions, Kr or Ar, so the mechanisms involved in pattern formation and coarsening are robust. We compare the experimental findings with simulations of a nonlinear continuum model based on ion-driven viscous flow, which reproduces many qualitative properties seen in the experiments. Such a comparison underscores the need for a suitable consideration of both external noise and the grain structure of the target to fully account for the large-scale properties of the process.

Index Terms-

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