

Ion damage overrides structural disorder in silicon surface nanopatterning by low-energy ion beam sputtering

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Abstract-

We investigate the role of the initial structural condition in silicon surface nanopatterning by low-energy ion beam sputtering. Specifically, we address the influence of the target atomic structure in ripple formation under oblique irradiation by 500 eV Ar⁺ ions. To this end, we compare results obtained on single-crystal, amorphous, and pre-implanted silicon targets. In spite of the differences in terms of structural order, and in contrast to previous results for medium energies, surface dynamics are found to be quantitatively similar in all these systems. We explain our results through Molecular Dynamics simulations of the initial irradiation stages, with the conclusion that the damage induced by low-energy ion bombardment overrides the initial atomic state of the silicon target, irrespective of its preparation method and allows silicon re-using for nanostructuring.

Index Terms- Micro- and nanoscale pattern formation; Interface structure and roughness; Atomic, molecular, and ion beam impact and interactions with surfaces

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Citation:

Castro, M.; Cuerno, R.; Gago, R.; Lorenz, K.; Moreno Barrado, A.; Muñoz-García, J.; Redondo-Cubero, A.; Vázquez, L. "Ion damage overrides structural disorder in silicon surface nanopatterning by low-energy ion beam sputtering", EPL, vol.109, no.4, pp.48003-p1-48003-p5, February, 2015.