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Wavelength Tunability of Ion-bombardment Induced Surface Ripples on Sapphire HUA ZHOU, LAN ZHOU, YI-PING WANG, RANDALL L. HEADRICK, Department of Physics, University of Vermont, AHMET S. OZCAN, YI-YI WANG, GOZDE OZAYDIN, KARL F. LUDWIG JR., Department of Physics, Boston University, DAVID P. SIDDONS, National Synchrotron Light Source, Brookhaven National Laboratory — Energetic particle bombardment on surfaces is known to produce well ordered 2-D (ripples or wires) and 1-D (dots) structures at submicron/nanoscale by a self-organization process. Recently, significant experimental and theoretical effort has been expended to develop methods to produce self-organized nanostructures on diverse substrates from semiconductors to metals. These studies have shown potential in tailoring surface morphology in order to exploit novel physical properties, and contributed much to reveal the mechanisms of the instability-driven self-organization process. In this work, a study of ripple formation on sapphire surfaces by ion sputtering is presented. Surface characterization by in-situ synchrotron grazing incidence small angle x-ray scattering (GISAXS) and ex-situ atomic force microscopy (AFM) for the wavelength, shape and amplitude of sapphire ripples is performed. The wavelength can be varied over two orders of magnitude by changing the ion incidence angle. The linear Bradley-Harper (B-H) theory with ion induced viscous flow (IVF) relaxation fits the general trends of the data. However, anomalous smoothing not predicted by current models is observed near normal incidence.

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