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Sputter induced ripples on Au(001) and Pd(001)

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Recently, ion beam sputtering have been received much attention because it shows possibility to make well-defined nano-patterns made of ripples and dots, while traditional lithographic techniques have limitation to produce such nano-patterns which can be useful as a template substrate for nano-device application. The order on the ion irradiated surface comes from the competition between erosion and diffusion process of sputter-induced adatoms. By tuning experimental parameters such as ion beam energy, flux, time and substrate temperature, we expect to refine the order and uniformity of nano-structures such as ripples and dots. Here, we carry out ion sputtering of some metal surfaces, Au (001) and Pd (001) with both single and dual ion beams. Ion beam sputtering at grazing incidence angle, gives rise to ripple structures of about 100 nanometers. To obtain better quality of ripple, We find that as the sputter time increases, the ripple becomes more regular in its wavelength and its aspect ratio does larger. However, after certain time, the evolution of surface morphology virtually ceases.

We also try to erase a ripple structure and rebuild a new one by sequential ion beam sputtering, in which the next ion-beam direction is perpendicular to the previous one. As time goes on, 90 degree rotated ripples compared with initial ones are finally produced. We find that in the middle stage, the sputtered feature does not show one dimensional character like one dimensional symmetry and axis lines. We also try dual ion-beam sputtering (DIBS) at grazing incidence angle in which the two beams perpendicular to each other bombarded target surface simultaneously. DIBS produces arrays of mounds and holes without any preferred orientation, and very weak, if any, is their long range correlation.