Electronic Design Automation
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Seminar

Designing self-organized nanopatterns on Si by ion irradiation and metal co-deposition

Dot and ripple nanopatterns on Si surfaces with defined symmetry and characteristic dot spacings of 50–70 nm were created by 1 keV Ar ion irradiation at normal incidence and simultaneous co-deposition of Fe atoms at grazing incidence. Fe was continuously supplied from different sputter targets surrounding the Si substrate, leading to a steady-state Fe content in the near-surface region of the substrates. The pattern formation is self-organized, most probably caused by ion-induced phase separation. Patterns were analyzed with atomic force microscopy and the Fe content in the irradiated layer was measured with Rutherford backscattering. The symmetries of the produced patterns are isotropic, four-fold symmetric, three-fold symmetric and various types of two-fold symmetric patterns, depending on the geometrical arrangement of the sputter targets. Pattern formation was studied for a steady-state coverage of Fe between 0.5 and 3.3 × 1015 Fe cm−2. The threshold coverage for the onset of pattern formation is about 0.5–1 × 1015 Fe cm−2. The coherence length of the patterns is comparable to the average dot spacing. Nevertheless, the autocorrelation analysis reveals a residual long-range periodicity of some patterns. The dot spacing can be adjusted between about 20 nm and several hundred nm depending on the ion species and ion energy.

Contact

Yushen.Zhang+Seminar@CIT.TUM.de

Advisors

Yushen Zhang