Simulation of nanocolumn formation in a plasma environment

J.W. Abraham, K. Fujioka, S. Wolf, T. Strunkus, F. Faupel, and M. Bonitz

ITAP, Christian-Albrechts-Universität, Kiel, Germany

Institut für Materialwissenschaft, Christian-Albrechts-Universität, Kiel, Germany

Recent experiments and kinetic Monte Carlo (KMC) simulations [1,2] demonstrated that physical vapor co-deposition of a metal alloy (Fe-Ni-Co) and a polymer (Teflon AF) can lead to self-organized growth of magnetic nanocolumns. While these experiments have been carried out with thermal sources, we analyze the feasibility of this process for the case of a sputtering source. For that purpose, we extend our previous simulation model [3] by including a process that takes into account the influence of ions impinging on the substrate [4]. The simulation results predict that metal nanocolumn formation should be possible. Furthermore, we show that the effect of ions, which create trapping sites for the metal particles, is an increased number of nanocolumns. We conclude by developing a microscopic analysis for the critical cluster size for the phase transition from spherical clusters to nanocolumns that is based on molecular dynamics simulations.

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References


