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Structure and growth simulation of GLAD sputtered thin films

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By using the glancing angle deposition technique (GLAD) [1], it has been shown that complex separated structures can be produced, like inclined columns, zigzags and helices. Films with such structures present a wide range of particular behaviours, and so the growth mechanisms should be investigated. Since some differences between experiments and theoretical results were noticed, simulation offers interesting tools to take into account the deposition parameters and to provide the growth prediction.
In this study, we present three series of columnar inclined thin films with different working pressures and target to substrate distances. For each series the inclination of the substrate in compared to the normal to the target is systematically change from 0 to 85°. Changing the pressure acts on the spatial distribution of the atom flux, and so, on the final column angle of the film. We found relation between the inclination angle and the column angle different in each case and different to the classical laws. Three simulation tools are used to reproduce this particular behaviour. First, SRIM [2] simulates the sputtered atom flux. This information is then used by SIMTRA [3], with the deposition conditions (pressure, dimensions...) and gives the impinging atom flux. Afterwards, Simul3D [4] simulates the growth of the film. Finally we compare the results obtained by experiments and simulations.
This work reports on simulations of thin film growth exhibiting inclined columnar microstructure. A dual approach is involved, by experiments and a complete panel of simulation tools. This allows a good prediction of the structure related to deposition conditions.
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