RSD2011 Abstract submission
Cover page

Reactive sputtering in 5D

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Reactive sputtering in 5D

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A crucial problem in the modeling of reactive magnetron sputtering is the full knowledge of all model parameters. The accuracy of these parameters is nevertheless of great importance when aiming for a truthful simulation of the observed hysteresis during Reactive Sputter Deposition (RSD). In an attempt to discover the complete parameter set defining the process, we fitted simulated hystereses of the RSD model [1] to experimentally measured ones.

The reactive systems under investigation are the sputtering of either Al or Y in a varied oxygen, fixed argon atmosphere. For each system three hystereses, i.e. oxygen flow-pressure relations, are measured for a different current. To simulate these experiments, we retrieve our parameters from three sources. Firstly, the working conditions directly define some of these parameters. Secondly, some material dependent parameters have been experimentally determined [2,3]. And finally, simulation tools like SRIM [4] and SIMTRA [5] further supply the RSD model with input. Eventually we are left with two unknown parameters.

During fitting, we consider five fit parameters consisting of the two unknowns and the three experimentally determined parameters. Variations in the experimental fit parameters are within their error intervals, while for the two unknown fit parameters, broad intervals are selected. An exception is the experimentally measured sputter yield of the oxide which is treated during fitting as an unknown, in order to have an internal verification of the approach. These five-parameter sets are evaluated on their goodness-of-fit with the experimental hystereses. For this purpose, an algorithm is developed to find all parameter combinations that give an acceptable fit within a connected region. The algorithm together with the RSD model is implemented to run in a parallel setup on the High Performance Computer infrastructure of the Ghent University. Only a minor amount of the parameter sets showed a good fit. A relationship between two fit parameters was found, giving insight in the impact of those parameters on the simulation. This relationship enables mutual comparison between the chemical reactivity of Al and Y with the implanted reactive gas ions.

References

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