IN SEARCH FOR THE ULTIMATE MODEL PARAMETERS OF REACTIVE MAGNETRON SPUTTERING

K. Strijckmans[1], W.P. Leroy[1], D. Depla[1]
[1] Research Group *DRAFT*, Dept; Solid State Sciences, Ghent University, Krijgslaan 281/S1, B-9000 Ghent, Belgium

It can be stated that finding the parameters which govern the reactive magnetron sputtering process is not straightforward. Those parameters are nevertheless a crucial input for a truthful simulation and modeling of the observed hysteresis in Reactive Sputter Deposition (RSD). For the RSD model [1] under investigation, we try to complete the parameter set by fitting simulated hystereses to measured ones.

The hysteresis phenomena, i.e. oxygen pressure-flow curves, studied are those of sputtering a metal, either Al or Y, in a varied oxygen atmosphere. Firstly, the experimental setup limits the parameter set. Secondly, results from other simulation software (SRIM [2], SIMTRA [3]) and from other experimental work [4,5], are used to further reduce the parameter set. Eventually the parameter set only contains three material dependent unknowns. Those three parameters are varied, and evaluated on their goodness-of-fit with the experiments. For this end, an algorithm is developed to find all the combinations of the three unknowns that give acceptable fits, which lay in 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. By simultaneously fitting to three different measurement, only a minor amount of the parameter sets show a good fit. Relationships between the three parameters were found and give insight in the impact of each parameter on the simulation. These relationships enable to pinpoint the full parameter set for each metal/oxygen combination. In this way reasonable suggestions can be made on the metal dependency of hard-to-collect parameters such as the chemical reactivity of implanted reactive gas ions in the target.

References:

[1] D. Depla et al. J.Phys D: Appl. Phys 2007.
[2] The Stopping and Range of Ions in Matter, 2006, http://www.srim.org.
[3] K. Van Aeken, et al., J. Phys D, Appl. Phys. 41 (2008) 205307, http://www.draft.ugent.be
[4] M. Saraiva, et al., J. Appl. Phys. 107 (2010) 034902.
[5] W.P. Leroy, et al., Plasma Process. Polym. 6 (2009) S342.