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# Influence of a control based on plasma parameters in a reactive sputter process on material properties

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Reactive sputtering is a common process for the deposition of ceramic compound layers such as aluminium oxide. A metallic target material is sputtered by ion bombardment and bonds with a reactive gas. A hysteresis effect can be observed as a result of target covering by the reaction with reactive gas. This leads to a modification of target surface conditions, such as sputtering yield and secondary electron emission coefficient. A high sputter rate is reached by a low reactive gas flow, but may lead to a metallic coating. A high reactive gas flow ensures the right stoichiometry in the deposited compound layer but causes the covering of the target. For this reason, a process control is needed, which has to operate in the hysteresis transition region.
Today, the intensity of a spectral line of the sputtered material or the partial pressure of the reactive gas are controlled to deposit defined coatings on a substrate. However, controls based on these parameters do not consider the influence on the plasma, which functions as the sputter source and has an influence on the layer formation on the substrate. In this work, a control which is based on plasma parameters is developed and the influence on the coatings conditions are investigated.
To determine the controlled variable, the multipole resonance probe (MRP) is used as a process monitoring system in a multi frequency CCP (MFCCP) sputter process. The secondary electron emission and therefore the target covering has an effect on the electron density, which can be measured by the MRP. For a controlled electron density, the number of incident ions on the target as well as the substrate are constant. This allows a more efficient process control which combines target and plasma processes. The hysteresis process can be transferred to the MRP measurements. Thus, an optimal working point for the control can be identified for a high deposition rate and a defined stoichiometry. In addition, material properties are investigated.

**Keywords**
sputtering
control
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