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Kinetic modelling of plasma enhanced chemical vapour deposition (PECVD) of BN-films

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Plasma modelling and simulation becomes increasingly more attractive as a tool for design, control, and optimization of plasma processing. This contribution presents kinetic modelling of plasma enhanced boron nitride (BN) thin film-deposition in the system argon-boron-nitrogen (Ar-B-N) with the software ChemkinPro®.
For the description of the plasma processes, the collision rates for the plasma processes, as ionization, excitation and dissociation were collected from databases in literature and they were transformed in the Arrhenius-parameter-form. In addition, neutral-neutral reaction processes in the volume are taken into account. The appropriate reaction rates in the volume are nearly completely known in the literature. However, they do not agree and must be analysed critically. The database for the surface reactions is fragmentary and not reliable. Therefore, we used critical surface data sets in parameter form and modelled the influence of different parameter sets on the reaction rates. The comparison of the modelling results with experimental findings gives the possibility to restrict the number of parameter sets and to qualify the databases.
Kinetic modelling is focused here in the first step on the system Ar-B-N to evaluate the influence of the concentration of nitrogen, argon, and boron as well as the influence of the gas- and electron-temperature and plasma power on the BN-growth rate. The results of modelling show that the tendency of BN-growth rate in dependence on various inlet parameters confirms experimental results.

Keywords
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