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Electron Monte Carlo model for a dual magnetron discharge, used for the sputter deposition of complex oxide layers

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Reactive sputter deposition is applied to produce compound thin films. For this technique, oxygen gas is added to an argon magnetron discharge, to deposit metal oxide films [1].
For the sputter deposition of materials consisting of (at least) two different elements, a so called dual magnetron is applied. The dual magnetron under study consists of two single magnetrons, positioned opposite to each other and tilted 45^0 to the axis of the substrate. Complex oxides can be manufactured when performing reactive sputter deposition in the dual magnetron setup. These films have improved structural, mechanical, optical and/or electrical properties [2,3].
The behaviour of the electrons is described with a Monte Carlo model: the trajectory of the electrons in the electric and magnetic field is calculated with Newton's laws. Their collisions are treated with random numbers. The model is not self-consistent, so the electric field, generated from a particle-in-cell/Monte Carlo calculation [4], is given as input in the simulations, as well as the magnetic field. Indeed, the static magnetic flux density is calculated using the finite element solver GetDP and the finite element mesh generator Gmsh [5].
In the present work, we study the behaviour of the electrons in a direct current dual magnetron discharge. We focus on different magnetic configurations (mirror and closed). We also investigate the influence of various parameters (e.g., gas pressure, discharge current).
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