Simulation of a magnetron discharge using CFD.

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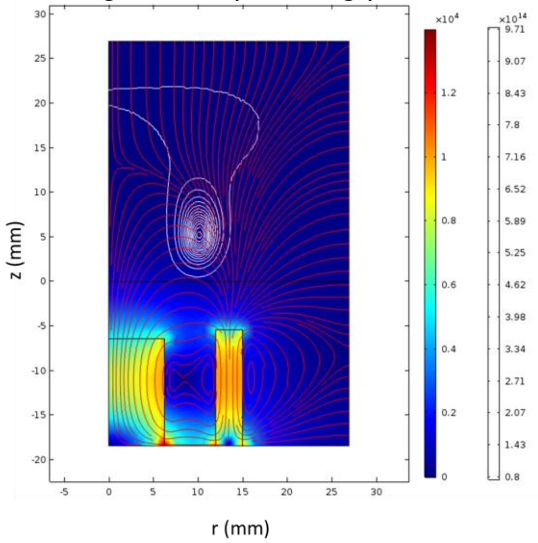
Nowadays, sputtering deposition is employed for coating synthesis in several domains (i.e. mechanic, optic, electronic…) [1]. To better understand discharge phenomena, numerical simulations associated with experimental results appear as a reliable tool. Different models with analytic, continuum or fluid, particle and hybrid approach can be used [2-4]. Among those, Particle-In-Cell/Monte Carlo Collision (PIC-MCC) is the most common despite a large computing time.

In this work, a Computational Fluid Dynamics (CFD) study using COMSOL Multiphysics®, based on the theoretical model from Costin *et al* [5], is performed. A DC magnetron discharge is simulated in a region close to the cylindrical symmetric target. This model allows the description of the magnetron discharge parameters as the magnetic field, the electric potential, the electrons and ions densities and mean energy. The transport of the electrons and the positive ions is described by the first three moments of the Boltzmann equation: continuity, momentum transfer and mean energy transfer (only for electrons), coupled with the Poisson equation. The coupling with the magnetic field requires some assumptions: classical drift-diffusion expression are used for flux and an effective electric field is considered for ions.

The results obtained will then be coupled, in further work, with Molecular Dynamic (MD) simulations [6-7] applied to the target and the deposition process in order to build a multi-scale approach of the magnetron sputtering process.



Representation of the calculated magnetic flux density (Gauss) and electron density levels in white (m^{-3})

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