

P2.3002 Forces applied on a spherical metal nanoparticle in a magnetized plasma

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See the full abstract here

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.3002.pdf>

The study of nanoparticle (NP) dynamics is done in a DC unbalanced magnetron discharge using argon plasma at 30 Pa. The plasma is produced between two electrodes: a 7.62 cm diameter tungsten cathode negatively biased and a stainless steel grounded anode 10 cm apart. The discharge current was fixed at 0.3 A and 0.5A. NPs are produced from cathode sputtering. They grow near the cathode and acquire a negative charge proportional to their size. They are transported in the plasma under the action of the following forces: two ion drag forces, one due to the collection of ions on a NP where the ions transfer their momentum to the NP and the second one due to the Coulomb scattering of the plasma ions on the NP where the ions deflect in the local electric field in the sheath surrounding the NP, electric force due to the plasma electric field, thermophoretic force due to a temperature gradient in the neutral gas, neutral drag force due to the resistance experienced by a nanoparticle moving through the gas, and the gravity.

The determination of the plasma parameters is necessary to calculate the applied forces. For this, the 2D magnetic field mapping of the magnetron system was established using a Hall probe. The 2D mappings of the plasma potential, the electron density and temperature were achieved using a cylindrical Langmuir probe. The 2D mapping of the balance of the forces applied to an isolated NP was then deduced as well as the trapping positions. The latter were discussed according to the magnetic field and electric field configurations. These results on the NP transport will be verified with laser extinction.

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