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# on heating and sheath structure in direct-current argon discharges at moderate pressures

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The impact of ion dynamics in the sheath of argon DC plasma discharges is analysed. We show that, at moderate pressures where the ion mean free path is of the order of the sheath width (10-150 Pa), the spatial variations of the ion temperature have a strong impact the sheath formation process, especially on the density profiles of plasma species and the mean velocity of the ions impacting the cathode. To show these findings, we compare simulation the data of DC argon discharges obtained from a Particles-In-Cell 1D3V (one dimension in space and three dimension in velocity) kinetic model with the simulation data of one-dimensional self-consistent fluid ones. Simulations show that ion collisions with neutral atoms must absolutely be considered in the fluid model to accurately simulate the discharge, especially in the sheath region, and s self-consistent calculation of the ion temperature profile is necessary in the whole simulation domain. In particular, in the cathode sheath where there is large potential fall, despite the relatively large ion-neutral frequency in the considered pressure range, the ion temperature can be several orders of magnitude larger than the background gas temperature. Kinetic simulations also showed that ion-neutral collisions are responsible for a progressive spreading of the ion velocities in the directions perpendicular to the electric field in the cathode sheath.

## Keyword-1

Ion heating

## Keyword-2

sheath

## Keyword-3

gas discharge

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