

From Hall thrusters to Plasma Display Panels Does modelling help plasma device design and optimisation ?

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Hall thrusters and Plasma Display Panels are two very different examples of practical applications of « low temperature plasma discharges » where the plasma is generated by electron impact ionisation of a background gas. Hall thrusters are used for satellite propulsion and operate in conditions where a flow of atoms is fully ionised by electrons trapped in a magnetic field. The reduced electron conductivity due to the transverse applied magnetic field induces a large local electric field in the plasma, which provides the electron heating necessary to generate the plasma, and accelerates ions outside the thruster. The gas density in the active region of a Hall thruster is low, from 10^{11} cm^{-3} or less to 10^{13} cm^{-3} . In a Plasma Display Panel, the operating pressure is close to atmospheric (typically 800 hPa, corresponding to a gas density in the 10^{19} cm^{-3} range), but the degree of ionisation is rather low, on the order of 10^{-5} at the time of peak current.

In this lecture we illustrate how modelling has helped understanding the basic properties of these two plasma discharge devices and we comment on the ability of the models to provide real hints for improving and optimising the design and operating conditions of these devices.