

Plasma-wall interaction: a new model of electron emission experimentally validated

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Hall Thrusters (HTs) plasma modelling is a major topic of research for space industry as it could have a determining impact on HTs design and optimization, which currently depend on empirical reasoning and onerous experiment without determining results. Numerous attempts have been made to reliably model HT plasma, but they are not able to explain all physical phenomena in HTs plasmas (e.g. electrons abnormal transport). Nonetheless, it is known that wall material has a non negligible influence on HTs performances [1, 2] and numerous modelling show that Electron Emission (EE) in HTs channel could have a determining impact on plasma behaviour (abnormal transport, etc.) [3, 4].

A new EE model suitable for HT plasma modelling is presented at this workshop. This model describes electron emission yield, emitted electrons angular distribution (EEAD) and emitted electrons energetic distribution (EEED) and differentiate secondary and backscattered electrons. This model is based on physical reasoning and not only fitted experimental data. It also depends on several physical parameters (material, incident electron angle, incident electron energy, material work function). This allows extrapolating results to a large range of physical environments. This model is being validated thanks to experimental measurements made at ONERA. These measurements concern Total Electron Emission Yield (TEEY, cf. Figure 1), EEED and energetic efficiency of electron/wall interaction (cf. Figure 2).

This model will be implemented in a Particle In Cell model developed at Laplace in order to determine the influence of EE on global HTs plasma behaviour.

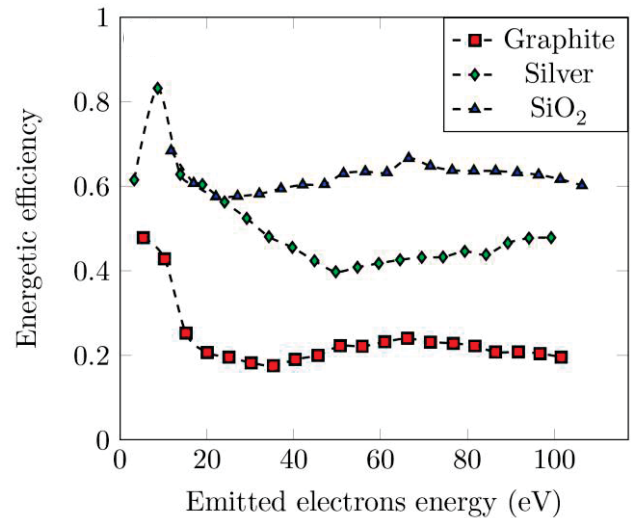
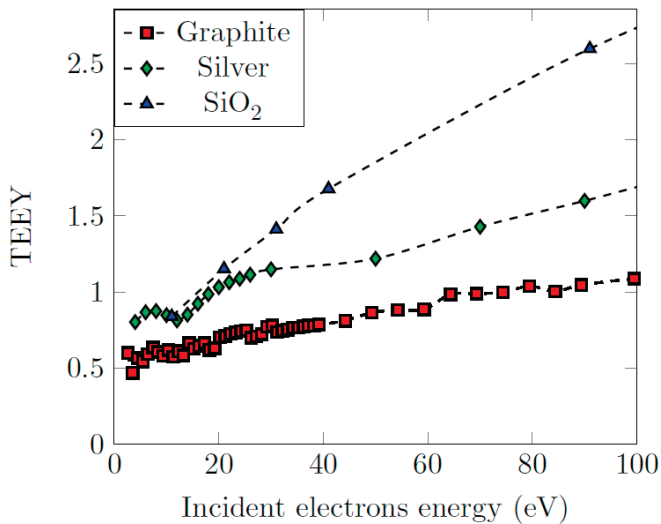


Figure 1 : TEEY measurement at low energy[5,6]

Figure 2: Energetic efficiency of electron/wall interaction at low energy

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