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A global model of the self-pulsing regime of micro-hollow cathode discharges CLAUDIA LAZZARONI, PASCAL CHABERT, LPP, CNRS-Ecole Polytechnique — A global model of the self-pulsing regime of Micro-Hollow Cathode Discharges (MHCD's) working in argon gas is proposed. The power balance is done using an equivalent circuit model of the discharge that allows the current and voltage dynamics to be calculated. The fraction of the total power dissipated in the discharge that contributes to electron heating is deduced from a sheath model. The particle balance is first done in a very simplified reaction scheme involving only electrons, argon atomic ions and argon molecular ions. In a second step, the excited states are included in the particle balance equations. The models are compared to experiments and several conclusions are drawn. The model without excited states underestimates the electron density and does not capture well the trends in pressure. The model with the excited states is in better agreement which shows that multi-step ionization plays a significant role. The time-evolution of the electron density follows closely that of the discharge current but the excited states density presents two peaks: (i) the first at the early stage of the current peak due to direct excitation with high electron temperature, (ii) the second at the end of the current (and electron density) peak due to large production of excited states by electron-ion recombination at very low electron temperature.

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