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Global Model of a Negative Hydrogen Ion Source with Caesiated Plasma Grid

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A global model is applied to investigate the complex chemistry in a negative hydrogen ion source with caesiated plasma grid. This global model includes electrons, neutral hydrogen molecules with all vibrational states ($H_2(v)$), hydrogen atoms in the first 3 electronic states ($H(n)$), and ground state ions (H^+ , H_2^+ , H_3^+ and H^-). It uses a comprehensive set of surface and volume chemical reactions including a model for negative hydrogen ion production from caesiated surfaces. In the global model, steady state species continuity equations, electron energy and total energy equations, heat transfer to walls, and quasineutrality are solved simultaneously in order to calculate number densities and temperatures of plasma components in the discharge over a wide range of pressures and absorbed powers. We present preliminary global model results for a plasma composition and species temperatures in a caesiated plasma grid extraction chamber of a negative hydrogen ion source. These results are used to extract the most important plasma species and chemical reactions for use in 2-Dimensional fluid simulations of plasma evolution in a cesiated plasma grid extraction chamber by the multi-species fluid code USim.

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