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Generation of Multi-charged High Current Ion Beams using the SMIS 37 Gas-dynamic Electron Cyclotron Resonance (ECR) Ion Source

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A gas-dynamic ECR ion source (GaDIS) is distinguished by its ability to produce high current and high brightness beams of moderately charged ions. Contrary to a classical ECR ion source where the plasma confinement is determined by the slow electron scattering into an empty loss-cone, the higher density and lower electron temperature in a GaDIS plasma lead to an isotropic electron distribution with the confinement time determined by the prompt gas-dynamic flow losses. As a result, much higher ion fluxes are available, however a decrease in the confinement time of the GaDIS plasma lowers the ion charge state. The gas-dynamic ECR ion source concept has been successfully realized in the SMIS 37 experimental facility operated at the Institute of Applied Physics, Russia. The use of high-power (~100 kW) microwave (37.5 GHz) radiation provides a dense plasma (~1013 cm3) with a relatively low electron temperature (~50-100 eV) and allows for the generation of high current (~1 A/cm2) beams of multicharged ions. In this work we report on the present status of the SMIS 37 ion source and discuss the advanced numerical modeling of ion beam extraction using the particle-in-cell code WARP.

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