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Optimization of Cathode Settings in a Low-Energy Electron Gun to Develop a Diagnostic Tool for H- Ion Source Plasmas

As a diagnostic tool for electron transports in H- ion source plasmas, we have been trying to realize a low-energy electron gun which can be installed inside H- sources and can work even at areas which are very close to or inside hydrogen ion source plasmas. We reported in the previous conference that our prototype gun generated 0.04 mA/cm2 as the maximum beam current density at 1 eV beam energy. To achieve our requirement, 1 mA/cm2, we tested a smaller cathode (filament) than before to obtain effective extractions of thermal electrons shortening their transport distances from a cathode to an extraction hole inside the gun. As a result, the current density increased more than three times larger than the previous result. The result gave us more attention to optimization of cathode settings in the gun. Thus, we will discuss it here with Particle-In-Cell simulation considering the detail cathode structure which was ignored in our previous work by employment of a rough approximation.

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