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Development of H- Ion Source for JYFL Pelletron Accelerator

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A filament-powered multicusp ion source for production of H- has been developed for the JYFL Pelletron accelerator for the usage at the ion beam lithography and PIXE applications. The source can be considered conventional with the exception of the filter field being created with an electric magnet for continuous adjustability. A permanent magnet dipole-antidipole electron dump is integrated in the puller electrode. The two magnetic fields are separated by a magnetic SS430 plasma electrode insert. The source has been characterized with emittance and current measurements. It provides up to 50 μA of H- beam at 10 keV energy with 0.019 mm mrad 95 % normalized rms emittance through 2 mm aperture. Even lower emittance should be achievable by adjusting the plasma-electrode to puller-electrode gap distance as it has been noticed that the extraction geometry is not optimal for the typical lower currents required by the applications. The plasma electrode insert can be changed to a larger aperture one if higher current is required. The ion source extraction is capable of handling beam from 4 mm diameter aperture providing up to 200 uA of H-. If lower emittance is desired, the aperture can also be made smaller. The source design, measurements and extraction ion optics simulations are presented along with the costs related to this high brightness ion source project.

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