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Source Performance Optimization in Cesium Mode in ROBIN

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ITER reference design, inductively coupled single driver RF-source ROBIN is operational at IPR, Gandhinagar. The first phase of the operation yielded H- ion current density of 22-25 mA/cm² and with electron to-ion ratios >1. The Cesium (Cs) consumption was very high compared to a similar source operated at IPP, Garching. The lessons learned from the operational experience showed the operational limitations in presence of impurities and excessive evaporation of Cs into the source. Since then the source was disassembled, cleaned, and reassembled to enable the restart of operations under improved and controlled conditions. Recent experiments assisted by relevant diagnosis on the cleaned ROBIN source under controlled cesiated conditions and improvements based on the lessons learned have resulted in achieving H- ion current densities >30 mA/cm² and electron to ion ratios < 1 and with Cs consumption reduced to ~12 mg/hr. Systematic studies related to parametric dependence on the source filling pressure and power have been performed with powers up to 80 kW coupled to the source at an RF frequency of 937 kHz. The role of plasma grid bias on the H- ion current densities, electron to ion ratios, beam transmission, plasma, and negative ion densities, and electron temperatures have been studied in detail. The observations and results related to Cs conditioning, source performance optimization, source parametric dependence on the beam, and related observations and findings related to the effects of the bias voltage on the source performance shall be presented and discussed.

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