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ICP Source with Immersed Ferromagnetic Inductor

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Application of ferromagnetic enhanced inductors in inductively coupled plasma (ICP) sources results in many attractive features comparing to traditional ICPs without ferromagnetic cores¹. Ferromagnetic enhanced ICPs, (FMICPs) have extremely high power transfer efficiency reaching 99%, that corresponds to 1% power loss in the inductor, which is an order of magnitude less than that in best helicon plasma sources. The ability to operate at low frequency (1-2 order of magnitude lower than that in traditional ICPs), with high power factor allows for elimination of matching networks, and practically absence of capacitive coupling make FMICP a superior plasma source for many applications.

A special class of FMICP having immersed inductor with ferrite core is reviewed in this presentation. Electrical and plasma characteristics measured for wide range of RF power (25-600 W) and gas pressure (1 mTorr-1 Torr) in Ar and Xe gas for few FMICP sources with immersed ferrite inductors are discussed. Particularly, the power transfer efficiency, inductor RF voltage and current, power factor, and extracted ion and electron currents are given as functions of RF power and gas pressure. A simple in construction compact plasma cathode (for thruster ion neutralization and for e-beam/plasma study) has been developed and its superior performance (comparing to known plasma cathodes) has been demonstrated. Similar advantage should be expected for ion sources build on the same scheme.

Reference

V. Godyak, Ferromagnetic enhanced inductive plasma sources J. Phys. D: Appl. Phys. **46** (2013) 283001 (23pp)