

Abstract Submitted
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Comparison of ICP with and without ferromagnetic core VALERY GODYAK, BENJAMEN ALEXANDROVICH, Osram Sylvania — In spite of common operational principles, there are fundamental differences in electrical properties of a conventional transformer and a conventional inductively coupled plasma, ICP. Due to a strong coupling between primary and secondary circuits provided by a ferromagnetic core with high permeability, a conventional transformer behaves very closely to an ideal transformer, where the primary impedance is merely the load impedance times square of the primary winding turns. Experimental results of comparative study of ICP operated with and without ferromagnetic core are reported here. Electrical characteristics and power transfer efficiency of ICP with air core and different kinds of ferromagnetic cores have been measured in ICP of Kr/Hg mixture operating at 0.4 and 2.5 MHz in the discharge power range between 2 and 200 W. The comparison was made for discharges having the same geometry, gas fill and discharge power. It has been shown that ICPs enhanced with ferromagnetic core have significantly larger primary power factor and power transfer efficiency than those operated without ferromagnetic core. An extremely high power transfer efficiency (99%) has been demonstrated for ICP with ferromagnetic core that corresponds to 1% power loss in antenna with ferromagnetic core. This number is an order of magnitude better than that in the best helicon plasma sources having reputation of the most efficient plasma source.

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