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On the uniformity of electric field controlled plasma sources

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Electric fields around antenna of ICP sources consist of capacitive as well as inductive ones. By quartz probe using piezoelectric resonance, electric fields were investigated around a single turn antenna. We have observed that the capacitive electric field which is nearly perpendicular to the inductive field is dominant inside a single-turn ring. The surface charge accumulates to cancel the inductive field and, at the same time, generates two orders of magnitude larger perpendicular field. Plasma density profile of normal single one-turn antenna clearly showed that the high capacitive electric field made plasma non-uniform.

Double Stack Antenna (DoSA) was developed to overcome this kind of asymmetry originated from high antenna voltage. Capacitive electric field of normal single one turn antenna is not uniform and this cause non-uniformity of plasma. In DoSA, the capacitive electric field was reduced and distributed uniformly by its unique antenna structure. DoSA consist of two or more same shaped antenna pieces and which were parallel connected to each other with making double-stacked geometry. Excellent uniformity of about 3% was obtained at very wide discharge parameter range. The z-window and pressure window were found to be about 100 mm and 3~30 mTorr.