PLASMA INDUCED ARCS IN A HF-DISCHARGE

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EXTENDED ABSTRACT

Plasma induced arcs may significantly contribute to the relativity large amount of impurities observed in controlled fusion devices /1/. They are supposed to be driven by the potential drop of the plasma sheath in front of the wall, therefore the term plasma induced arcs. Theoretical values for the threshold of the voltage needed to drive such an arc are below 10 V, a value which may be hard to avoid at the edge of thermonuclear plasmas.

The following problems need to be clarified experimentally:

- do plasma induced arcs really exist, i.e. can arcs be generated only by the plasma induced potential drop in front of a wall;
- what are the plasma conditions for the existence repectively the suppression of these arcs;
- what wall conditions have to be chosen to avoid arcs or to reduce their harmfulness.

A careful study of such arcs is difficult to do in a nuclear fusion experiment. We have therefore attempted to devise an experiment in which a plasma is generated with properties similar to those near the limiter of a tokamak, i.e. an electron density between 10^{12} cm^{-3} and 10^{13} cm^{-3} an electron temperature$\approx$10 eV.

To this end a rf transmitter (140 kW, 3 MHz, 0.3 ms pulse length) is coupled inductively to a cylindrical plasma (4 cm diameter, 10 cm length). By the electrodeless discharge breakdown can be achieved down to 1 mbar H_2 without a superimposed static magnetic field. Electron densities greater than 10^{13} cm^{-3} are generated in a hydrogen plasma. The plasma exhibits a strong skin effect which pertains over the length of the rf pulse. Nearly the total rf power is coupled into the plasma corresponding to a power density of 500 W/cm^3. The electron temperature is several eV.

Metal probes (Cd, Cu, SS) have been exposed to the plasma for 10...100 ms. Surface erosion has been observed on all three metals. Crater like traces are dominant. The craters have been analysed. The mean diameters are 1 - 3 µm for Cu, 3 - 15 µm for SS and 3 - 20 µm for Cd.

Results so far obtained do indicate that the rf-electric field is not responsible for the observed arcs.

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REFERENCES

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