

Modulation of the parameters of a weakly Debye plasma by means of a current pulse

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MODULATION OF THE PARAMETERS OF A WEAKLY DEBYE PLASMA BY MEANS OF A CURRENT PULSE

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Study of the time-relaxation of the plasma parameters n_e and T_e , during and after a current pulse can provide useful insight in the excitation-ionization equilibrium and in the transport properties of the plasma.

We used an atmospheric cascaded arc in argon ($\phi = 8$ mm) operating at 80 amperes. Accurate values for T_e , n_e and n_a were determined in the stationary state by the source function method ¹ and by Ashby-Jephcott interferometry (2 lasers : 0.63 μ m and 3.39 μ m) ².

By the application of a current pulse (150 Amps; 500 μ s; 10% droop; 3 μ s rise and fall times), the plasma is forced temporary in a different stationary state. Using the same diagnostics we evaluated the time-evolution of T_e and n_e ; see figure 1. We observe a substantial increase in n_e (factor 2.5) and a 15% increase in T_e ; also the corresponding enhancement of continuum and Ar II line radiation has been observed.

Conclusions : 1. By current modulation, measurements at high current densities can easily be performed with good accuracy.

2. Large radiation enhancement can be attained.

3. By negative modulation (and/or afterglow) the number of particles in the Debye sphere can be reduced.

1. J. Leclair, D. Schram, Proc. 13th ICPIG, Berlin 1977, p. 483.

2. V. Helbig, private communication (to be published).

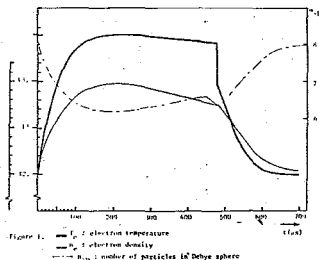


Figure 1. — T_e : electron temperature
 - - - n_e : electron density
 - · - n_D : number of particles in Debye sphere

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