Scaling in a Radiofrequency Discharge

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New macroscopic parameters for the design and scaling or radiofrequency discharges are introduced and discussed. The variables are:

$$\frac{Yd}{\pi r^2 \omega \varepsilon_0} \quad , \quad \frac{V}{p_o d} \quad , \quad p_o \Lambda \quad , \quad \nu/\omega$$

where Y is the admittance of the discharge, p_o is the reduced pressure, ω is the angular frequency of the applied field, ν is the momentum collision frequency, Λ is the diffusion length and V/d is the average electric field across the discharge. Only three of the four parameters are independent. These parameters are related to the traditional scaling factors

$$E/p_o, \; p_o\Lambda, \; j/p_o \text{ and } \; /\nu/\omega$$

which, along with other chemical variables determine the rates of chemical reaction in an electric discharge. However, the traditional variables may vary both spacially and with time inside a given discharge while the new variables remain constant and can be derived from externel quantities.

Analytical relationships between these two sets of parameters are given along with implications for the scaling of chemical reaction.

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