Helium plasma microjet for combined RF radiation and plasma treatment

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The estimation of electrical characteristics of radiofrequency (RF: 13.56 MHz) He plasma jets in open atmosphere without any shielding is complicated by the existence of emitted RF radiation which disturbs electrical measurements. In this work we generate a plasma jet by applying rf power to a hollow needle through which there is a flow of helium. In this configuration, the radiated RF power exceeds the power deposition in the plasma (see fig. 1), and the classical technique for determining I (V) through a phase shift analysis is inaccurate. We present an alternate method for determining the ratio between the power dissipated in plasma jet and the radiated power.

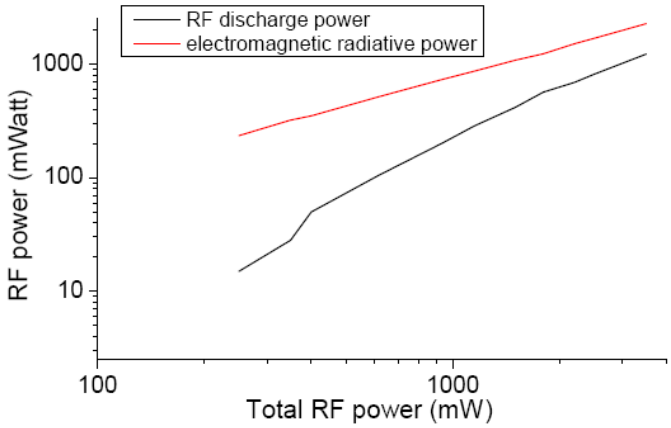

Fig 1: *RF power deposited in the helium plasma jet compared to radiated RF power.*

In term of applications, this work demonstrates that plasma jets generated by radiofrequency excitation are always accompanied by RF radiation. This last point is not necessarily a negative because some treatments use radiofrequency to treat tumors [1].

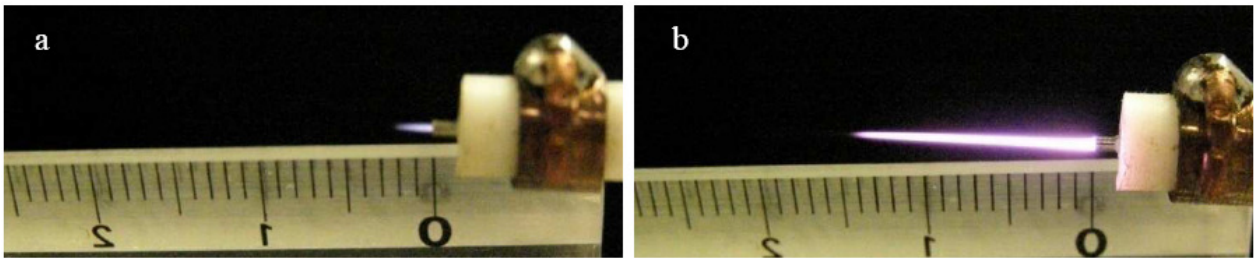

Fig 2: *RF He plasma jet: a) 15.6 mW, b)1.8W accompanied respectively by irradiated powers of 135mW(a) and 3.2 W(b)*

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References

[1] V. Mazzaferro et al, Ann Surg. (2004); 240(5): 900–909