Self-consistent simulation of hydrogen-methane plasmas for CVD diamond deposition

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MW assisted hydrogen methane plasmas have been extensively used for growth of CVD diamond and graphene. In this article, we discuss the results of self-consistent simulation of hydrogen-methane plasmas in a microwave resonating cavity at high pressure conditions (110-200mbar) and different concentrations of methane. Details of the self-consistent model is provided elsewhere [1]. The results indicate that the pressure, power and concentration of methanne in the $H_2 - CH_4$ methane affect the characteristics of the coupling between MW and plasma. Figure 1 shows the gas temperature and atomic hydrogen concentration at a pressure of 200 mbar and power 2500 W. The results are in agreement with experimental observations. It is seen that the addition of methane increases the temperature of the reactor. As a result the the dissociation of hygrogen increases with addition of methane. The results are similar at 110 mbar. n general, the plasma characteristics is a function of methane concentration, pressure and MW power.

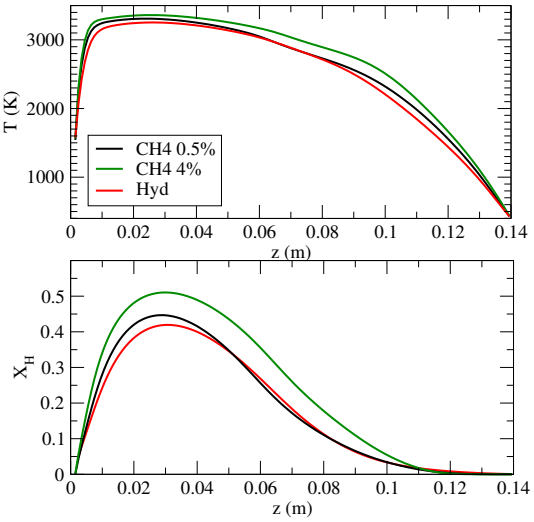

Figure 1: Effect of methane on the temprature and atomic hydrogen mole fraction at 200 mbar and 2500 W at the axis of the plasma reactor

References

[1] S. Prasanna et al. Plasma Sources Science and Technology **26.9 (2017)**