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O3.302 Influence of molecular admixtures on filamentation in microwave plasma torch

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Microwave (MW) discharges are one of the most flexible plasma devices operating under wide range of experimental conditions which makes them suitable for many practical applications. However, at atmospheric pressures, the plasmas tend to contract, forming the spatially inhomogeneous and possibly temporally unstable plasma filaments. In contrast, most applications require homogeneous, stable and repeatable operating conditions. Detailed study of filament formation and sustaining is therefore of utmost importance for both basic and applied plasma science.
We investigated a filamentary regime in MW plasma torch, which used atmospheric pressure argon flowing through central electrode [1]. Main experimental parameters were the input MW power, flowrate of argon and amount (0-10%) of admixture (oxygen, hydrogen, nitrogen). With an outlook to a graphene synthesis more complex molecular admixture (ethanol) was used, too.
Fast imaging and optical emission spectroscopy were used as diagnostics.
The process of contraction and filamentation was strongly influenced by the molecular admixture. Observed reduction of filament length can be easily explained by the loss of energy to vibrational and rotational excitations of the molecular admixture. The causes of changes in radial intensity profile are more complex as they involve e.g. thermal conductivity of various gases [2]. Nitrogen admixture generally produced more diffuse filaments than other admixtures. Spatial profile of the local gas temperature was calculated from the emission spectra, too.

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References
[1] L. Zajickova et al., Plasma Phys. Control. Fusion, 47, (2005). [2] M. Moisan et al., Springer Science, (2012).

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