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Sheath and bulk expansion in atmospheric pressure microwave plasma via RF field induction

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An extensive elongation of microwave driven plasma jet at atmospheric pressure is achieved with a low power RF field at an axial location well isolated from the original plasma bulk. The progressive development of volume expansion visualized by high speed ICCD imaging as well as calculated by the equation of motion for the electron cloud suggests that the free electrons drifting toward the bias electrode promote the remarkable expansion of the sheath, resulting in a stable plasma stream channel between the electrodes. Enhanced emissions of OH and N<sub>2</sub> spectral lines for the case of argon microwave plasma also support the acceleration of electrons and subsequent generation of radical species. Ozone generation from the dual frequency plasma is kept below the regulation level, as low as the microwave plasma alone. The coupling of RF field in a few MHz range with microwave allows an enlargement of the microwave plasma volume and enhancement of the radical production.

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