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Formation of reactive oxygen species and negative ions in radio-frequency driven He/O_2 atmospheric pressure plasmas JOCHEN WASKOENIG, TIMO GANS, Centre for Plasma Physics, Queens University Belfast, BT7 1NN Belfast, Northern Ireland, UK — Revealing and tailoring the formation mechanisms of reactive oxygen species (ROS) in cold helium-oxygen atmospheric pressure plasmas is crucial for controlled technological exploitations, in particular for sensitive treatments in bio-medicine. One- and two-dimensional numerical simulations are used to investigate the dynamic plasma chemistry in radio-frequency driven plasmas. The presented fluid model, with semi-kinetic treatment of electrons, is benchmarked against high-speed imaging of the electron dynamics and active optical measurements of ROS. The code describes 17 plasma species with 142 reactions among them. The obtained simulation results agree very well with the experimental measurements and provide deep insight into details of production and destruction mechanisms. The formation of ROS and negative ions can be described fairly accurately by only a few important plasma chemical reactions. This allows a relatively simple analytical description based on coupled balance equations. The total density of negative ions is predominantly governed by the effective mean electron energy and relatively independent of the plasma density. Consequently, the electro-negativity of the plasma is comparatively high at low input powers and decreases towards higher powers.

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