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Experimental and computational characterization of He+H_2O plasmas at atmospheric pressure

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Atmospheric pressure plasmas have received growing attention in recent years for their economic and scientific potential. In many of the envisioned applications (e.g. sterilization, surface modification, biomedical applications, air pollution, water treatments, etc.), water plays an important role on determining the discharge characteristics. In this contribution, I present the results of experimental and computational studies aimed at unravelling the chemistry and dynamics of low-temperature He+H_2O atmospheric pressure plasmas envisioned for biomedical applications. In these discharges helium is used as a buffer gas and helps keeping the discharge temperature low. While in many atmospheric pressure systems water is present as an impurity, here water is deliberately introduced in the discharge and used as a precursor of reactive species of biomedical relevance. By means of a comprehensive global model (46 species and 576 reactions), optical spectroscopy, and mass spectrometry, the discharge is characterized as a function of the water concentration and main species/reactions are identified. Finally, the chemistry of He+H_2O plasmas is compared with that of He+O_2 plasmas commonly used in the growing field of plasma medicine.