

Loughborough University
Institutional Repository

*Delivering fluxes of reactive
species of cold
atmospheric-pressure
plasmas through the electrode
sheath region*

This item was submitted to Loughborough University's Institutional Repository by the/an author.

Citation: YANG, A. ... et al, 2012. Delivering fluxes of reactive species of cold atmospheric-pressure plasmas through the electrode sheath region. IN: Abstracts of the 2012 IEEE International Conference on Plasma Science (ICOPS), 8th-13th July 2012, Edinburgh, UK, pp. 3P-20

Additional Information:

- This conference paper was presented at the 2012 IEEE International Conference on Plasma Science (ICOPS), held in Edinburgh in July 2012.

Metadata Record: <https://dspace.lboro.ac.uk/2134/16409>

Version: Accepted for publication

Publisher: IEEE

Rights: This work is made available according to the conditions of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) licence. Full details of this licence are available at: <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Please cite the published version.

DELIVERING FLUXES OF REACTIVE SPECIES OF COLD ATMOSPHERIC-PRESSURE PLASMAS THROUGH THE ELECTRODE SHEATH REGION

Aijun yang¹, Xingzhen Wang¹, Mingzhe Rong¹, Dingxin Liu¹, Xiaohua Wang¹, Felipe Iza², and Michael G Kong^{1,2}

¹ *State Key Lab of Electrical Insulation and Power Equipment, Xi'an Jiaotong University, Xi'an, 710049, P.R. China.*

² *School of Electronic, Electrical and System Engineering, Loughborough University, Leicestershire, LE11 3TU, United Kingdom*

Cold atmospheric-pressure plasmas have received much attention; mainly rely on the potential use of reactive species generated in such plasmas. In most cases of application, such as plasma medicine, the reactive species have effects on a sample only after their penetration through the plasma sheath that is formed above the sample. In contrast to studies of generation and optimization of reactive species with the plasma itself, much less research has been reported on delivering of reactive species through the sheath region. The latter is quantitatively investigated in this paper for radio-frequency plasmas in atmospheric He+O₂ mixture, by means of a fluid model. It is found that the electrode fluxes of plasma species are dominated by the plasma sheath, because the diffusion length is very small as a result of high collisionality at atmospheric pressure. So, the fluxes of reactive plasma species can be controlled by adjusting the sheath, which in turn can be controlled by altering, for example, the excitation frequency, the applied voltage, and the electrode gap. At a constant input electrical power, it is shown that high fluxes of reactive plasma species, particularly anions such as O₂⁻, may be facilitated by low excitation frequency, small gap distance, or voltage bias applied to an electrode. This effect is particularly pronounced when the sheath thickness becomes comparable to the electrode gap distance.

* Work supported by National Science Foundation of China (NSFC) , No.50907053