

Decoding of atmospheric pressure plasma emission signals for process control

V J Law¹, D P Dowling², J L Walsh³, F Iza³, N B Janson³, and M G Kong³

¹Dublin City University, National Center of Plasma Science and Technology, Collins Avenue, Glasnevin, Dublin 9, Dublin, Ireland
(e-mail: vic.law@dcu.ie)

²School of Electrical, Electronic and Mechanical Engineering, University College Dublin, Belfield, Dublin 4, Ireland

³Department of electronic and Electrical engineering, Loughborough University, Leicestershire LE11 3TU UK

⁴School of Mathematics, Loughborough University, Leicestershire LE11 3TU UK

Abstract: low-temperature, non-thermal atmospheric pressure plasmas (APP) are being developed for surface treatment of biomedical devices, sterilisation, and therapeutic techniques, such as wound sterilisation and cancer treatment. In addition to these medical applications, APP are now routinely employed in the automotive (car head lamps) and aerospace (fuselage and wing components) industry for surface activation of polymer prior to bonding. The impact of this technology offers enhanced quality of care at reduced cost and will be of immense societal and commercial value.

The invited plenary talk shall focus on the emerging plasma optical and electro-acoustic metrology that is being developed for these atmospheric pressure plasmas. In particular the requirement for extraction of information that describes the tempo-spatial heterogeneous processes, presently this technology is in its infancy when compared to low pressure plasma metrology. The new metrology multivariate analysis tools for the deconvolution and compression of single observables such as time-vary electrical current and electro-acoustic signals are presented for three different and contrasting plasma processes. The APP metrology will pertain to: the hand held plasma jet (needle) [1] reel-to reel APP [2, and 3], and CNC controlled plasma jets [4, and 5].

Keywords: plasma, electrical harmonics, acoustic overtones, acoustic impedance

⁴th Chaotic Modeling and Simulation International Conference, CHAOS2011
31 May – 3 June 2011, Agios Nikolaos, Crete, Greece

References

- [1] J. L. Walsh, F. Iza, N. B. Janson, V. J. Law and M. G. Kong Three distinct modes in a cold atmospheric pressure plasma jet. *J, Phys, D: Appl, Phys* 43(7), 075201 (14pp), 2010.
- [2] V. J. Law, J. Tynan, G. Byrne, D. P. Dowling, and S. Daniels. The application of multivariate analysis tools for non-invasive performance analysis of atmospheric pressure plasma. *Chaotic Systems: Theory and Applications*. 147-154, Ed by C. H. Skiadas and I. Dimotikalis. (World Scientific Publishing 2010). ISBN 978-981-4299-71-8.
- [3] J. Tynan, V. J. Law, P. Ward, A. M. Hynes J Cullen, G. Byrne, D. P. Dowling and S. Daniels. Comparison of pilot and industrial scale atmospheric pressure glow discharge systems including a novel electro-acoustic technique for process monitoring, *PSST*, **19**, 015015, 2010.
- [4] D. P. Dowling, S. J. Langlais, F. T. O'Neill and V. J. Law, Influence of dc pulsed atmospheric pressure plasma jet processing conditions on polymer activation Submitted to *Plasma Process Polym*. September 2010.
- [5] C. E. Nwankire, V. J. Law, A. Nindrayog, B. Twomey, K. Niemi, V. Milosavljević, W. G. Graham, and D. P. Dowling. Electrical, thermal and optical diagnostics of an atmospheric plasma jet system. *Plasma Chem, Polym, Processing*. **30**(5) 537-552, 2010.