Potential of Emerging Electrostatic Technologies for Bio-Medical and Environmental Applications

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***Abstract*— Manipulating and dispensing liquids on the micrometre and nano scale is important in biotechnology and combinatorial chemistry and also for patterning inorganic, organic and biological inks. The pyroelectric effect, which enables the release of electric charges, has been known as physically observable phenomena for many centuries. However, it is only since about 1960 that the technological applications of pyroelectricity have been seriously considered. The effect occurs in any material, single crystal, ceramic or polymer, which possesses polar point symmetry, as in the case of Lithium Niobate and Lithium Tantalate. The temperature variation in the polar dielectric crystal causes the generation of high electric fields. This pyroelectric effect can be utilised for EHD inkjet printing without the need for a nozzle, electrodes and high voltage power source. This pyro-electrohydrodynamic effect has been successfully used in varied fields such as biomedicine, forensic analysis, environmental monitoring, biosensing and in many other applications. It is relatively simple to draw attolitre liquid droplets from one or more sessile drops or liquid film reservoirs using pyroelectrohydrodynamics. Tissue scaffoldings for Organ-on-a Chip can be created using micro-pyro-electrospinning without the need for a nozzle and high voltage electronic circuit. In this presentation, the basic technology will be outlined and elegant applications reported in the literature will be reviewed.**

The second part of the presentation will cover the other end of the spectrum of controlling environmental pollution caused by NOx, SOx and PM from flue gas emissions. Non-thermal plasma technology is becoming a serious contender compared to well established electrostatically charged water scrubber for removal of SOx and PM, and selective catalytic reactor for removing NOx. Recently demonstrated technology of cold plasma generated by dielectric barrier discharge in conjunction with granular activated carbon will be critically reviewed with respect to NOx removal efficiency and energy requirements.