

# Effects of plasma gases on the electrical properties of polyester fabric for application in Textile - Triboelectric Nanogenerators

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Triboelectric Nanogenerators have proven to be an effective method of electrical energy generation and their efficiencies have shown a steady increase [1]. However, the development of textile-based TENG devices (T-TENGs) has been slow and challenging at times. By utilising commercially available materials, the only remaining issues are related to the scale up of the treatment process, increasing the longevity and electrical efficiency of textile triboelectric materials. By utilizing dielectric barrier discharge (DBD) plasma (Figure 1), it is possible to modify the surface functionality of fabrics. DBD plasma generates free radicals, functional groups and ions that bombard the surface of the materials, removing weak ionic bonded groups, and replaces them [2]. Since triboelectricity is primarily the movement of electrons between the surface of oppositely charged materials, this replacement of surface functional groups directly affects the electrical properties. This study represents a comparative look at plasma treatments from an electrical perspective and a step towards fully wearable T-TENG devices. Detailed investigations are currently underway to understand the mechanism by which plasma gases influence the triboelectric properties of polyester fabrics. After plasma optimisation and treatment these functionalised fabrics are systematically characterised using XPS, FTIR, contact angle and electrical characterisation, to compare the effects of each plasma on the material surface. When compared to the untreated polyester fabric, a N<sub>2</sub> based plasma treatment resulted in an electrical output increase of 90%, while a CO<sub>2</sub> based plasma treatment led to a 62% decrease. These electrical changes prove that through basic plasma treatments it is possible to influence the overall electrical outputs of fabric materials and thus the overall efficiency of T-TENGs.

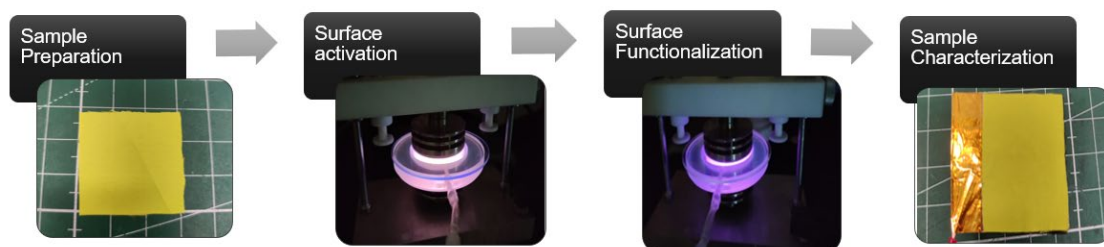


Figure 1: Experimental procedure for plasma treatment of polyester fabric.

## References

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- [2] A. Zille, F.R. Oliveira, A.P. Souto, Plasma Treatment in Textile Industry, *Plasma Processes and Polymers*, 12 (2015) 98-131.