Triboelectric generators based on plasma-etched flexible surfaces

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Triboelectric generators (TENGs) have attracted significant scientific interest since the pioneering work of Fan et al. in 2012 [1]. The triboelectric phenomenon is based on contact electrification and electrostatic induction between two surfaces in relative motion. Several techniques have been proposed for controlling the surface roughness and thus triboelectric generator performance.

In this work, we investigate the modification of flexible surfaces (PET, Kapton®, etc.) using plasma processing on the electrical performance of TENGs. Etching and roughening of the sample surfaces was conducted in oxygen plasma with source power ranging from 300 to 1900W, bias power ranging from 50 to 300W and etching duration ranging from 40 to 240s, resulting in different surface roughness conditions (Fig.1a).

Electrical characterization of the samples was performed in contact-separation mode. As a reference surface different types of electrodes were used for the triboelectric generator, corresponding to both "hard" and "soft" substrates, such as SiO_2, Kapton®, PET, PTFE, etc. The output voltage was monitored as a function of time using an oscilloscope. In addition, charging experiments were performed through a rectifier bridge and capacitor (0.47μF) circuit (Fig. 1b)

From the comparison of the voltages generated by the different triboelectric couples and the corresponding capacitor charging, conclusions are drawn regarding the matching of the different micro- and nano- structured surfaces and the effect of hard and soft reference electrodes.

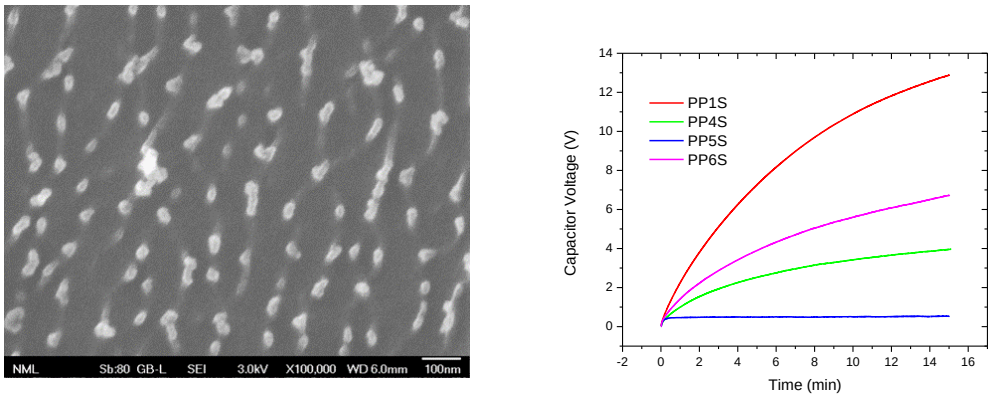

Figure 1 a) SEM images of PET surfaces after oxygen plasma-induced roughness and b) Capacitor voltage as a function of time for the four different PET samples.

Reference

[1] F. R. Fan, Z. Q. Tian, Z. L. Wang, Nano Energy 1 (2012) 328-334

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