

FACTORS THAT INFLUENCE THE TRIBOELECTRIC CHARGING OF TEXTURED PLASTIC SLABS IN CONFORMAL CONTACT

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ABSTRACT

The tribo-electrostatic nano-generators (TENGs) is only one of the numerous industrial applications that exploit the triboelectric effect, i.e. the electric charge transfer between material surfaces in mechanical contact [1]. It is known that surface texture has the ability of modifying the friction and wear at contact interfaces [2]. Therefore, surface morphology is expected to have an impact on the triboelectric charging process. The aim of this paper is to evaluate the factors that might affect the triboelectric charging of 3D-printed textured plastic slabs in conformal contact.

The experiments were carried out using a custom-designed linear tribometer (Fig. 1 a) to create the electric charge through friction between two samples, a fixed Aluminum bar and a mobile PLA slab. The distribution of electric charge on the surface of the PLA slab was measured with an electrostatic probe (Fig. 1 b). Three types of samples (size: 50 mm × 50 mm x 5 mm), were prepared by 3D printing, with “lines”, “zigzag” and “waves” texture (depth: 1 mm; Fig. 1 c). The triboelectric laboratory bench allows for the control of the relative sliding speed, the normal contact force, and the number of back-and forth cycles [3].

The PLA samples were tribocharged, then scanned by the electrostatic probe entrained by the 2D mapping system, to obtain the distribution of the electric potential, which reflects that of the electric charge. Displayed on Fig. 1 d is the map of the electric potential at the surface of a PLA sample with “lines” texture, subjected to 20 tribocharging cycles.

The results of the experiments point out the interactions that exist between the type of texture and each of the factors listed above. These interactions should be taken into account in the design of any device that exploits the triboelectric effect, such as the TENGs and the tribochargers for electrostatic separation applications.

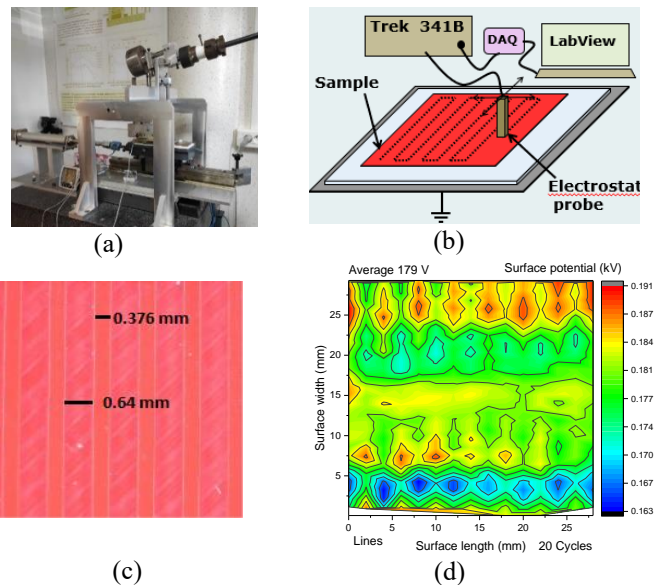


Fig.1 (a) Linear tribometer; (b) Electric potential measurement; (c) Line-type-textured sample; (d) Map of the electric potential at the surface of the line-type-textured sample.

References

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