Understanding Triboelectric Charging at the Molecular Scale: an Atomic Force Microscopy based Approach

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The triboelectric effect is experienced many times every day and is used in macroscopic applications such as energy harvesting from ocean tides and in nanoscopic devices such as triboelectric nanogenerators (TENGs) [1, 2]. Both have in common that they harvest energy by contacting pairs of tribo-functional materials. In order to optimize and develop new triboelectric materials and devices, we need to understand the mechanism and origin of charge separation at the molecular scale. Here, we present a combination of two different AFM-based techniques study to the extent of charge separation after contacting various materials. Atomic Force Microscopy (AFM)-based force spectroscopy is used to contact the respective materials. Kelvin Probe Force Microscopy (KPFM) is performed to obtain the surface potentials before and after such contacting experiments. This combination of techniques paves the way for the characterization and understanding of the triboelectric effect at the molecular scale and will provide a platform to test new triboelectric materials for future functional polymer-based material systems.

Reference

[1] Z. L. Wang, ACS Nano, vol. 7, No. 11, 9533-9557, 2013.

[2] Z. L. Wang, Faraday Discussion, vol. 176, 447-458, 2014.