Physical Chemistry Seminar

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"Triboelectric Nanogenerators:
Harvesting Mechanical Energy Using Polymer Films"

Abstract: Charges induced in triboelectric process are usually referred as a negative effect either in scientific research or technological applications, and they are wasted energy in many cases. Here, we demonstrate a simple, low cost and effective approach of using the charging process in friction to convert mechanical energy into electric power for driving small electronics. The triboelectric nanogenerator (TENG) is fabricated by stacking two polymer sheets made of materials having distinctly different triboelectric characteristics, with metal films deposited on the top and bottom of the assembled structure [1]. Once subjected to mechanical deformation, a friction between the two films, owing to the nano-scale surface roughness, generates equal amount but opposite signs of charges at two sides, respectively. Thus, a triboelectric potential layer is formed at the interface region if the generated triboelectric charges are separated by a small distance; the electrons in the external load are driven to flow for generating an induced potential for screening the triboelectric potential. This is the mechanism of the trioboelectric nanogenerator. An TENG gives an output voltage of up to 18 V at a current density of ~0.13 uA/cm^2 [2]. Recent report gives an output voltage of ~220 V [3]. TENGs have the potential of harvesting energy from human activities, rotating tires, ocean waves, mechanical vibration and more, with great applications in self-powered systems for personal electronics, environmental monitoring, medical science and even large-scale power.