Optimization Of Piezoelectric-Triboelectric Hybrid Generator Design

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Abstract

Devices which scavenge energy from ambient mechanical sources such as human body movement and ocean waves are undergoing rapid research and development. Both triboelectric and piezoelectric effects have been employed in the design of such devices. In this work, we use the MEMS Module in COMSOL Multiphysics® to model a hybrid piezo-tribo generator. We compare two device architectures: a layered structure vs. embedded inclusions. We find that the layered structure has a better performance due to enhanced stresses in the piezo material. We also explore the effect of mechanical properties of electrode materials on device performance. We find that metals are more effective than polymers in imparting stress to the piezo layer, thereby resulting in higher output voltages. This study highlights the interplay between electrical and mechanical properties in determining the output of a hybrid piezo-tribo generator. This can be combined with the knowledge of experimental constraints to come up with viable device architectures.

Figures used in the abstract

Figure 1 : Voltage in a piezo-tribo generator. When the device is stressed, the reduction in the triboelectric contribution is compensated by the piezo.