

Effects of material stress on triboelectric charging

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Abstract— Recent theoretical [1] and experimental [2] studies have proposed that triboelectric charging between chemically identical, insulating materials may occur as a result of electron transfer. Electrons could exist in insulators in trapped electronic states (i.e. within the wide bandgap) and, during contact, transfer from a high energy state in one material to a lower energy state in another. However, only a few reports have measured or probed these trapped electrons to support their existence [3]. Here, we explore the effect of material stress on triboelectric charging which could explain how trapped electrons are created. Elastomeric sheets are biaxially stretched over a cylinder with a controlled stress/strain. The sheets are then contacted with one another in various combinations (two unstretched, one stretched/one unstretched, and two stretched) and the charge is measured with an electrical probe. We find that stretching the material results in significantly more charging as compared to the unstretched material and the degree of stretching (i.e. strain) is also important. These results suggest that material stress may create or increase the number of trapped electrons and lead to enhanced charging of insulator materials.

REFERENCES

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