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A New Mechanical Loading Configuration for Maximizing The Performance of Dielectric Elastomer Generators SAMUEL SHIAN, JIANGSHUI HUANG, ZHIGANG SUO, DAVID CLARKE, Harvard University — Electrical energy can be generated from mechanical deformations using dielectric elastomers but currently achieved energy densities and conversion efficiencies are still small. In this presentation, we demonstrate that significant improvements, an energy density over 500 mJ/g and up to 10% in efficiency, can be produced using VHB elastomers by altering the mechanical loading geometry. A major limitation is viscous losses in the VHB elastomer indicating that higher efficiencies with other elastomers will be attainable. The basic concept of mechanical energy harvesting with a dielectric elastomer sheet is a straightforward electromechanical cycle leading to a voltage step-up: a sheet is stretched, electrical charge at low voltage is placed on either side using compliant electrodes, the stretch is released causing the sheet's initial thickness and area to be recovered increasing the charge potential which can then be harvested. Integral to maximizing the energy conversion is the amount of mechanical energy that can be stored elastically and the amount of capacitance change in the elastomer sheet during stretching. We show that these factors can be maximized by equi-biaxial loading. Details of our dielectric elastomer generator will be described as well as the procedures we use for quantifying its performance.

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