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Buckling Instability of Dielectric Elastomeric Plates for Soft, Bio-Compatible Microfluidic Pumps BEHROUZ TAVAKOL, Virginia Tech, MICHAEL BOZLAR, GUILLAUME FROEHLICHER, CHRISTIAN PUNCKT, HOWARD A. STONE, ILHAN AKSAY, Princeton University, DOUGLAS HOLMES, Virginia Tech — Dielectric elastomers are well-known for their superior stretchability and permittivity. A fully-clamped thin elastomer will buckle when it is compressed by applying sufficient electric potentials to its sides. When embedded within soft, silicone rubbers, these advanced materials can provide a means for a bio-compatible pumping mechanism that can be used to inject bio-fluids with desired flow rates into microfluidic devices, tissues, and organs of interest. We have incorporated a dielectric film that is sandwiched between two thin, flexible, solid electrodes into a microfluidic device and utilized a voltage-induced out-of-plane buckling instability for pumping of fluids. We experimentally quantify the voltage-induced plate buckling and measure the fluid flow rate when the structure is embedded in a microchannel. Additionally, we offer an analytical prediction that uses plate buckling theory to estimate the flow rate as a function of applied voltage.

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