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**Voltage Bursting Drops in Solids** QIMING WANG<sup>1</sup>, Duke University, ZHIGANG SUO<sup>2</sup>, Harvard University, XUANHE ZHAO<sup>3</sup>, Duke University — Droplets in air or liquids under electrical voltages appear in diverse processes from thunderstorm cloud formation, ink-jet printing, electrospinning nanofibers to electrospray ionization. In these processes, the electrostatic energy competes with surface energy of the drops and causes sharp tips to form on the ends of the drops. Here, we report a physically distinct scenario for droplets in solid matrices under voltages. We show that water drops in elastic polymers can form sharp tips and surprisingly burst into long tubes under applied voltages. The new phenomenon is governed by the elasticity and fracture of the solids, instead of the drops' surface energy as in previous cases. A new scaling is derived for the critical electrical field of the voltage-induced instability of drops in solids. The observations and analyses have significant practical impacts, as they illustrate the mechanism of a major failure mode, defect-induced breakdown, of dielectric polymers, which are widely used as insulating cables and polymer capacitors and transducers.

<sup>1</sup>Soft Active Materials Laboratory, Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC 27708, USA

<sup>2</sup>School of Engineering and Applied Science, Harvard University, Cambridge, MA 02138, USA

<sup>3</sup>Corresponding author, Soft Active Materials Laboratory, Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC 27708, USA

Qiming Wang  
Duke University

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