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Effect of Electrode Composition on the Partial Discharge Activity of a Pre-Stretched Dielectric Elastomer Actuator

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Dielectric Elastomer Actuators (DEAs) are a class of electroactive polymers, materials which exhibit a mechanical strain as a response to an electrical stimulus, capable of achieving high actuation strains over 100 %. A key hindrance in the application of DEAs is their need for high voltage in order to actuate, leaving their operating range close to their breakdown range. Therefore, this work explores the analysis of partial discharge activity as a precursor to breakdown of DEAs. The voltage induced strain of a DEA is affected by their surrounding electrodes, which add stiffness to the system. The DEA may also be limited by electromechanical instability, a positive feedback loop caused by an increasing electric field and thinning elastomer, leading to electrical breakdown. Pre-stretching the elastomer results in the suppression of electromechanical instability. This paper presents a comparison of partial discharge and breakdown characteristics of a pre-stretched DEA based on electrode composition.

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