Abstract Submitted
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Hand-generated piezoelectric mechanical-to-electrical energy conversion plasma[1] JINYU YANG, OLIVIA JAENICKE, FEDERICO HITA, University of Notre Dame, SEONG-KYUN IM, University of Notre Dame and Korea University, DAVID GO, University of Notre Dame — This work examines electrical characteristics of the transient spark generated by a manually-powered piezoelectric energy conversion device. Conventional methods to generate transient sparks usually require a high-voltage input. Piezoelectric crystals offer alternatives that do not require a high-voltage input and can be powered with mechanical work. Here, a piezoelectric igniter was utilized as the plasma source, and a snail cam-and-follower actuator was designed to provide repeatable mechanical actuation. Electrical analysis of the generated discharge shows that it behaves as a transient spark, discharging 0.53 mJ over about 30 ns, with consistent behavior over multiple consecutive actuations. While this specific device has a low energy conversion efficiency of 0.85%, its relatively short resetting time of ˜8 s suggests that it could be operated with mechanical input up to nearly 125 kHz. This work shows the potential that in situ pollution mitigation or plasma-enhanced combustion can be applied to off-the-grid situations by recovering waste energy of other mechanical systems. Greater promise can be achieved with mechanical systems that naturally operate at frequencies similar to the maximum achievable by the piezoelectric system.

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