Pyroelectric Driven Atmospheric Pressure Gas Discharges

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Abstract— **Atmospheric plasma configurations are often driven by large potentials applied to one or more electrodes. Depending on the configuration, thousands of volts are required to cre-ate breakdown in air and to initiate a discharge. To reduce the amount of potential re-quired, inherent characteristics of certain polar non-centrosymmetric crystals are investi-gated to determine if they can be beneficial to discharge formation. Being non-centrosymmertic allows for mechanical, thermal, or electrical forces to alter the crystal structure to change the magnitude of the polarization within the crystal. This change in polarization can lead to rapid changes in surface potential and be used to generate a sus-tainable discharge. Effectively, these crystals can be used to amplify potential applied to them through the piezoelectric, pyroelectric, and ferroelectric effects. In this work, stable atmospheric pressure discharges are generated using pyroelectric crystals using input heat. By thermally-cycling a pyroelectric crystal, an atmospheric pressure gas discharge was generated through the input of heat leading to a corona-like discharge as shown in Fig. 1. Systematic parametric studies were conducted to understand how the thermal cy-cling parameters affect discharge formation and optimal operating conditions.**