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Study of the operational properties of the Capillary Plasma Electrode (CPE) discharges JOSE LOPEZ, DAVID JACOME, WEI-DONG ZHU, Saint Peter's College, MARGARET FIGUS, Merck & Co., Inc., KURT H. BECKER, Polytechnic Inst. of NYU — Various approaches have been pursued to create stable atmospheric pressure discharges by extending the lifetime of the diffuse phase of the discharge to hundreds of microseconds. Previous research showed that the stability of the diffuse mode is dependent on the frequency (in the kHz range), gas type power, mode of the excitation, and geometrical confinement. Some of the most promising approaches are based on the recognition of the arc formation in high-pressure plasmas can be avoided and stable high-pressure plasma can be generated and maintained when the plasma are spatially constricted to the dimensions of tens to hundreds of microns. The Capillary Plasma Electrode (CPE) discharge is stable to produce stable atmospheric pressure nonequilibrium plasma. The CPE is similar in design to the Barrier Electrode Discharge, but has perforated dielectrics. The configuration, aside from exhibiting a diffuse mode of operation, also exhibits the so-called "capillary jet" mode, in which the capillaries turn on and a bright plasma jet emerges from the capillaries. The capillary jets from adjacent capillaries overlap so that the discharge appears uniform when the electrode contains an array of holes. There appears to be a threshold frequency for the capillary jet formation, which is strongly dependent on the L/D ratio of the capillaries, where D is diameter of the capillary and L its length. However, the operating principles and basic properties of this behavior are not well understood. The current work explores these modes of operations of the CPE by characterizing the electrical and optical emission properties of this discharge by examining a multi-hole discharge as well as a single capillary discharge reactor.

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