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Self-Organization in DBDs on a Single Pulse: Periodic Structures and Diffuse Discharges¹ NATALIA YU. BABAEVA², MARK J. KUSHNER, University of Michigan — Self-organization in dielectric barrier discharges (DBDs) occurs in many forms, from patterns of isolated plasma filaments to more complex arrangements. This self-organization typically develops over many discharge pulses, and is often related to charging of the dielectrics. Another aspect of DBDs is the transition from filamentary to diffuse discharges. The diffuse mode can be achieved at high repetition rate over many pulses, or on a single discharge pulse using overvoltage enabled by a fast-rising applied voltage. In computational studies of DBDs using a 2-dimensional plasma hydrodynamics model, evidence has been found for self-organized-patterns (SOPs) during a single discharge pulse. The conditions are an over-voltaged DBD sustained in humid air with two dielectric layers. We first found a transition between an isolated filament and a more diffuse discharge in raising the applied electric field to approximately 100 kV/cm. The diffuse discharge is sensitive to the surface-ionization-waves (SIWs) that propagate along both dielectrics, and the relative permittivity of those dielectrics. Upon increasing voltage further, SOPs are formed by periodic ionization waves launched into the gap from the edges of the SIWs. The gap-crossing ionization waves may be either positive or negative depending on the relative capacitance of the top and bottom dielectrics.

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> Mark Kushner University of Michigan

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