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Numerical study of the ignition behavior of a post-discharge kernel injected into a turbulent stratified cross-flow THOMAS JARAVEL, JEFFREY LABAHN, MATTHIAS IHME, Stanford University — The reliable initiation of flame ignition by high-energy spark kernels is critical for the operability of aviation gas turbines. The evolution of a spark kernel ejected by an igniter into a turbulent stratified environment is investigated using detailed numerical simulations with complex chemistry. At early times post ejection, comparisons of simulation results with high-speed Schlieren data show that the initial trajectory of the kernel is well reproduced, with a significant amount of air entrainment from the surrounding flow that is induced by the kernel ejection. After transiting in a non-flammable mixture, the kernel reaches a second stream of flammable methane-air mixture, where the successful of the kernel ignition was found to depend on the local flow state and operating conditions. By performing parametric studies, the probability of kernel ignition was identified, and compared with experimental observations. The ignition behavior is characterized by analyzing the local chemical structure, and its stochastic variability is also investigated.

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