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Analysis of Gas-Phase n-Dodecane-Air Cellular Detonations YORAM KOZAK, Tel Aviv University, SAI SANDEEP DAMMATI, Texas AM University, ALEXEI POLUDNENKO, University of Connecticut — Gas-phase detonations are found in a wide range of settings, including industrial explosions and advanced propulsion systems, such as detonation-based engines. The defining characteristic of detonations is their unstable nature, which is manifested in a complex cellular structure due to the interaction between transverse waves and the leading shock. Propulsion applications typically rely on heavy hydrocarbon fuels, similar in properties to n-dodecane. Detonation properties in such complex fuels remain virtually unexplored in detailed numerical studies. Here we present two-dimensional numerical simulations of gas-phase n-dodecane-air cellular detonations in stoichiometric and lean mixtures, which use a 24-species reduced chemical mechanism. Detailed investigation of different parameters, such as grid resolution and domain size, is performed. Detonation structure and dynamics are analyzed using numerical soot foils, as well as Lagrangian tracer particle analysis of thermochemical trajectories. Our findings reveal, for the first time, the typical cell size and structure produced by this highly unstable mixture. Finally, we discuss the implications of this study for the development of improved chemical mechanisms for heavy hydrocarbon detonations.

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