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Mach Number Effects on Ignition and Mixing Processes in a Reacting Shock-Bubble Interaction STEFAN HICKEL, Delft University of Technology (TU Delft), FELIX DIEGELMANN, VOLKER TRITSCHLER, Technische Universität München — We investigate reacting shock-bubble interactions (RSBI) by direct numerical simulations (DNS) with detailed chemical reaction kinetics. The bubble contains a stoichiometric H_2-O_2 gas mixture and is surrounded by pure N_2. The interaction with a planar shock wave induces Richtmyer-Meshkov instability. Secondary instabilities develop into a turbulent mixing zone at the bubble interface. The transmitted shock focuses at the downstream pole of the bubble and may ignite the bubble gas. To trigger different reaction wave types, we performed DNS of RSBI for shock Mach numbers in the range of $Ma = 2.13$ - 2.50 at a constant initial pressure of $p_0 = 0.50$ atm. Deflagration, dominated by H, O and OH production, is observed for a shock Mach number of $Ma = 2.13$. Increasing the shock Mach number reduces the induction time and eventually leads to deflagration-detonation transition. Ignition by a $Ma = 2.50$ shock wave directly leads to a detonation wave, driven by HO_2 and H_2O_2 high-pressure chemistry. Richtmyer-Meshkov instability, subsequent Kelvin Helmholtz instabilities, and bubble expansion are highly affected by the reaction wave. Mixing is significantly decreased by both reaction waves types. In particular detonation waves reduce the mixing distinctly.

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