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Steady Detonation Propagation in Thin Channels with Strong Confinement MARK SHORT, STEPHEN VOELKEL, CARLOS CHIQUETE, Los Alamos National Laboratory — We examine asymptotically the dynamics of 2D steady detonation wave propagation and failure for a strongly confined high explosive (HE), where the width of the explosive is small relative to the reaction zone length. An energy balance equation is derived which shows how the longitudinal acceleration of subsonic flow behind the detonation shock is influenced both by chemical reaction and by the effects of HE boundary streamline deflection, specifically via the induced rate of change of mass flux through the detonation wave. The latter serves to either counteract or reinforce the acceleration of longitudinal flow depending on the gradient of the boundary streamline deflection. The analysis is valid for general equations-of-state and chemical reaction rates in the HE. The energy equation represents an eigenvalue problem for the detonation phase speed. We explore specific results for the ideal- and stiffened-gas equations of state, along with a pressure-dependent reaction rate for which changes in the pressure exponent and reaction order are also studied. We consider the influences of both straight and curved HE boundary streamline shapes. The asymptotic analysis reveals significant physical insights into how detonation propagation and failure is affected by strong confinement.

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