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Diffusion-flame ignition by shock-wave impingement on a supersonic mixing layer ANTONIO L. SANCHEZ, CESAR HUETE, FORMAN A. WILLIAMS, University of California San Diego, JAVIER URZAY, Stanford University CTR — Ignition in a supersonic mixing layer interacting with an oblique shock wave is investigated analytically and numerically under conditions such that the post-shock flow remains supersonic. The study requires consideration of the structure of the post-shock ignition kernel that is found to exist around the point of maximum temperature, which may be located either near the edge of the mixing layer or in its interior. The ignition kernel displays a balance between the rates of chemical reaction and of post-shock flow expansion, including the acoustic interactions of the chemical heat release with the shock wave, leading to increased front curvature. The analysis, which adopts a one-step chemistry model with large activation energy, indicates that ignition develops as a fold bifurcation, the turning point in the diagram of the peak perturbation induced by the chemical reaction as a function of the Damkhler number providing the critical conditions for ignition. Subsequent to ignition the lead shock will rapidly be transformed into a thin detonation on the fuel side of the ignition kernel, and, under suitable conditions, a deflagration may extend far downstream, along with the diffusion flame that must separate the rich and lean reaction products.

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