

论文

可燃气体中激波聚焦的点火特性

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摘要 数值模拟了二维平面激波从抛物面上反射在可燃气体中聚焦的过程,研究了形成爆轰波的点火特性.对理想化学当量比氢气/空气混合气体,在初始压强20kPa的条件下,马赫数2.6~2.8的激波聚焦能产生两个点火区:第1个点火区是反射激波会聚引起的,第2个点火区是由入射激波在抛物面上发生马赫反射引起的.这种条件下流场中会出现爆燃转爆轰,起爆点分别分布在管道壁面、抛物反射面和第2点火区附近.起爆机理分别为激波管道壁面反射、点火诱导激波的抛物面反射和点火诱导的激波与第2点火区产生的爆燃波的相互作用.不同的点火和起爆过程导致了不同的流场波系结构,同时影响了爆轰波传播的波动力学过程.

关键词 [激波聚焦](#) [点火](#) [爆燃波](#) [爆轰波](#) [抛物面](#)

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Ignition characteristics of the shock wave focusing in combustive gases

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Abstract

The two-dimensional plane shock wave focusing with the parabolic reflectors in combustive gases is numerically simulated, and the ignition characteristics of the detonation initiation are investigated. In the stoichiometric hydrogen/air mixtures under 20 kPa, the shock wave focusing with the incident Mach number $2.6 \sim 2.8$ will generate two ignition zones. One is derived from the reflection shock convergence; the other is derived from the high temperature zone, which is induced by Mach Reflection on the parabolic reflectors. Then the focusing shock wave with the incident Mach number $2.6 \sim 2.8$ will induce the detonation initiation via deflagration-to-detonation transition. The initiation points locate on the tube wall, the parabolic reflector and near the second ignition point, separately. The corresponding initiation mechanisms are the shock wave reflection on the tube wall, the shock reflection on the parabolic reflector, and the interaction of the ignition-induced shock and the deflagration induced by the second ignition zone, respectively. Different ignition and detonation initiation processes result in various wave systems in the flow field, and lead to different wave dynamic processes of the detonation wave propagation.

Key words [shock wave focusing](#) [ignition](#) [deflagration wave](#) [detonation wave](#) [parabolic reflector](#)

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