Detonation Initiation and DDT: Experiments and Numerical Simulations

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Abstract

The paper outlines recent efforts of the Laboratory of Explosion Processes directed by the author on better understanding the mechanism of detonation initiation and deflagration-to-detonation transition (DDT) in gases and fuel drop suspensions. The main objective of the studies was to reveal the conditions ensuring fast DDT at extremely low ignition energies. Various scenarios of fast detonation onset were considered and tested experimentally and computationally. Among them are: (1) shock-to-detonation transition (SDT) in the presence of traveling ignition sources, (2) SDT due to coherent shock interaction with a cloud of preconditioned reactive mixture, (3) SDT due to shock focusing in curved tube segments (U-tubes and tube coils), (4) DDT in tube segments with regular shaped obstacles, etc. The use of certain combinations of these approaches made it possible to register DDT in highly insensitive liquid fuel – air mixtures applying the ignition energy on the level of 1 J.