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Using PDV to Understand Damage in Rocket Motor Propellants
GARETH TEAR, DAVID CHAPMAN, Imperial College London, PHILLIP OTTLEY, QinetiQ, WILLIAM PROUD, Imperial College London, PETER GOULD, IAN CULLIS, QinetiQ — There is a continuing requirement to design and manufacture insensitive munition (IM) rocket motors for in-service use under a wide range of conditions, particularly due to shock initiation and detonation of damaged propellant spalled across the central bore of the rocket motor (XDT). High speed photography has been crucial in determining this behaviour, however attempts to model the dynamic behaviour are limited by the lack of precision particle and wave velocity data with which to validate against. In this work Photonic Doppler Velocimetery (PDV) has been combined with high speed video to give accurate point velocity and timing measurements of the rear surface of a propellant block impacted by a fragment travelling upto 1.4 km s^{-1}. By combining traditional high speed video with PDV through a dichroic mirror, the point of velocity measurement within the debris cloud has been determined. This demonstrates a new capability to characterise the damage behaviour of a double base rocket motor propellant and hence validate the damage and fragmentation algorithms used in the numerical simulations.

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