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Laser-induced air shock from energetic materials (LASEM) method for estimating detonation performance: challenges, successes and limitations.

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Recently, a laboratory-scale method for measuring the rapid energy release from milligram quantities of energetic material has been developed based on the high-temperature chemistry induced by a focused, nanosecond laser pulse. The ensuing exothermic chemical reactions result in an increase in the laser-induced shock wave velocity compared to inert materials; a high-speed camera is used to record the expansion of the shock wave into the air above the sample surface. A comparison of the characteristic shock wave velocities for a wide range of energetic materials revealed a strong linear correlation between the laser-induced shock velocity and the reported detonation velocities from large-scale detonation testing. This has enabled the use of the laser-induced air shock from energetic materials (LASEM) method as a means of estimating the detonation performance of novel energetic materials prior to scale-up and full detonation testing. Here, we report new applications of the LASEM method and discuss the challenges and limitations of the technique. While the extension of LASEM to novel high-nitrogen energetic materials and aged conventional energetic material samples has been quite successful, non-organic and other highly reactive samples present some unique challenges.