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Fiber Grating Sensor System to Measure Velocity, Position, Pressure, and Temperature during Burn, Deflagration and Detonation of Highly Energetic Events
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A novel very high speed fiber grating sensor system has been used to support velocity, position, temperature and pressure measurements during burn, deflagration and detonation of energetic materials including explosives and rocket propellant in Russian DDT tests. For the first time the system has been demonstrated in card gap testing and has allowed real time measurements of the position of the blast front into the card gap and monitoring of pressure at key locations in the card gap test. Fiber grating sensors are capable of providing a continuous measurement of the position, velocity, local pressure and temperature of energetic materials during the early stages of detonation and the transition to full detonation represents a significant advance in diagnostic capabilities. These measurements provide insight into this dynamic regime detonation physics. Continuous velocity and burn back position measurements are significantly more accurate in determining this run-up in velocity relative to single point measurements which yield only the average velocity measurement between the individual pin placement points. This work describes the first demonstration of this technology to card gap testing.