

Shock and Particle Velocity Determination from Microwave Interrogation

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Abstract : Microwave interrogation in the range 10-100 GHz is identified as an advanced technique to investigate simultaneously shock and particle velocity measurements. However, it requires the understanding of electromagnetic wave propagation in a multi-layered moving media. The existing models limit their approach to wave guides or evaluate the velocities with a fitting method, restricting therefore the domain of validity and the precision of the results. Moreover, few data of permittivity on high explosives at these frequencies under dynamic compression have been reported. In this paper, shock and particle velocities are computed concurrently for steady and unsteady shocks for various inert and reactive materials, via a propagation model based on Doppler shifts and signal amplitude. Refractive index of the material under compression is also calculated. From experimental data processing, it is demonstrated that Hugoniot curve can be evaluated. The comparison with published results proves the accuracy of the proposed method. This microwave interrogation technique seems promising for shock and detonation waves studies.

Keywords : electromagnetic propagation, experimental setup, Hugoniot measurement, shock propagation

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