Using Laser Interferometry to Measure the Shock Wave Response of 1050 Aluminum

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Objective
- 1050 aluminum is commonly used in shock wave experiments as an impactor and a buffer
- Knowing its shock wave response is useful
- Laser interferometry measures the shock response wave

Experimental Details
- A 1050 aluminum disk was accelerated using a powder gun and impacted on another 1050 aluminum target
- The back surface motion of the target was monitored using laser interferometry

Laser Interferometry
- Doppler-shifted light from the back surface is split into two legs
- An etalon delays one leg by a short time (~0.4 ns)
- When the beams are recombined, they generate interference fringes
- By counting fringes, the rear surface velocity can be calculated
- The wave plate and polarizing beam splitters shift the four signals 90° out of phase with each other
- A beam intensity monitor is used for diagnostic purposes

Results and Discussion
- Two experiments were performed at different impact velocities
- As expected, the final velocities were consistent with the independently measured impact velocity
- The difference in wave structures suggested shock wave response of 1050 Al depends on the impact stress

1050 aluminum – 14 GPa
Impact Velocity = 1.61 mm/µs

1050 aluminum – 11 GPa
Impact Velocity = 1.29 mm/µs

Acknowledgments
I would like to thanks Drs. Yoshi Toyoda, Yogendra Gupta and Nicholas Sinclair for their help and insight, as well the entire engineering staff at the Institute for Shock Physics

This work was supported by the DOE/NNSA Grant No. DE-NA0002007