MASTER

WEDGE TEST DETERMINATION OF THE UNREACTED
SHOCK HUGONIOT OF HNS I

J. H. Van Velkinburgh

DEVELOPMENT DIVISION

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Sandia Laboratories
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Mason & Hanger-Silas Mason Co., Inc.
Pantex Plant
P. O. BOX 647
AMARILLO, TEXAS 79177
806-335-1581

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ABSTRACT

The unreacted shock Hugoniot and distances to detonation of HNS I (Chemtronics Lot 66-48 and PX Lot 03-76-0329-001) were measured using the wedge test technique. Measurements were made on samples of nominal density 1.60 Mg/m^3 and at input pressures between 2 and 8 GPa.

DISCUSSION

The purpose of this investigation was to determine the unreacted shock Hugoniot and distances to detonation of two lots of high purity HNS I. The two lots tested were Chemtronics 66-48 and PX 03-76-0329-001, both being at a nominal density of 1.60 Mg/m^3 . Measurements were made via the wedge test technique with the shock being produced using a P-081 plane wave lens and a 25.4 mm thick Baratol (76/24 Barium nitrate/TNT by weight) explosive pad, then passing through various thicknesses of attenuation plates before being transmitted to the HNS I wedges.

Wedges were manufactured by first pressing pellets 25.4 mm in diameter by approximately 8 mm tall. An angle of 0.2443 radians was then machined on the pellet making a wedge having a finely feathered toe and a heel of 6.33 mm. It was found to be necessary to mix 0.5% by weight of calcium stearate with the HNS I powder so that a machinable pellet would result. Pellets with no calcium stearate tended to chip, flake or fall apart when machining was attempted.

Aluminized Mylar strips of $13 \mu\text{m}$ thickness and of approximately 3 mm width were glued on the face of the wedge where the slit of the streaking camera would be focused. Each aluminized Mylar strip was placed with the aluminum surface in contact with the pellet and lightly glued near the edge of the strip only. There was no glue bond between the wedge and the Mylar strip where the streaking camera would observe. The wedges were held to the final attenuator plate by small glue spots around the edge of the wedge. Thus, there was no glue bond between the wedge and the attenuator plate. Two wedges, one from each lot of material, were used on each shot.

Table I gives the attenuator plate system and the shock condition in the final attenuator plate for each shot. Table II gives the conditions in the HNS wedges. Plots of the distance to detonation as a function of the transmitted pressure, and of shock velocity and pressure as a function of particle velocity are given in Figs. 1 through 3, respectively.

COMMENTS; CONCLUSIONS

The two lots of high purity HNS I tested performed very much alike in the wedge test.

Table I. Conditions in Attenuator System

<u>Shot No.</u>	<u>Attenuator Plates</u>	<u>Final Brass Plate</u>	
		<u>Particle Velocity (m/s)</u>	<u>Pressure (GPa)</u>
1076-6-11-2	25.4 mm Brass* 12.7 mm Plexiglas 12.7 mm Brass	255	8.8
1076-6-17-1	25.4 mm Brass*	744	30.1
1076-6-17-2	25.4 mm Brass* 12.7 mm Plexiglas	561	21.5
1076-6-18-1	38.1 mm Brass*	631	24.7
1076-6-18-2	25.4 mm Brass* 25.4 mm Plexiglas	520	19.7

**Final Attenuator Plate*

Table II. Transmitted Shock Conditions in HNS Wedges

<u>Shot No.</u>	<u>HNS Lot No.</u>	<u>Initial Density (Mg/m³)</u>	<u>Transmitted Shock Velocity (m/s)</u>	<u>Detonation Velocity (m/s)</u>	<u>Distance To Detonation (mm)</u>	<u>Transmitted Particle Velocity (m/s)</u>	<u>Transmitted Pressure (GPa)</u>
1076-6-11-1	66-48*	1.614	2510	***	***	452	1.83
	0329**	1.600	2317	***	***	457	1.69
1076-6-17-1	66-48	1.610	3727	6303	0.84	1266	7.60
	0329	1.600	4108	6799	0.84	1248	8.20
1076-6-17-2	66-48	1.610	4028	6515	1.41	941	6.10
	0329	1.588	3755	7520	1.58	953	5.68
1076-6-18-1	66-48	1.617	3885	6979	1.11	1065	6.69
	0329	1.594	4041	7167	1.17	1061	6.83
1076-6-18-2	66-48	1.606	3189	6875	1.88	901	4.61
	0329	1.606	3320	6803	1.82	896	4.78

*Chemtronics Lot 66-48

**PX Lot 03-76-0329-001

***Did Not Detonate

Fig. 1. Distance to Detonation Versus Transmitted Pressure for HNS I

Fig. 2. Shock Velocity Versus Particle Velocity for HNS I

Fig. 3. Transmitted Pressure Versus Particle Velocity for HNS I