Miniaturization of Insensitive Initiation Chains

K. Rudolf, B. Eigenmann, D. Clément

Diehl BGT Defence GmbH & Co. KG, Fischbachstr. 16, 90552 Röthenbach/Pegn., Germany

Contact mail: karl.rudolf@diehl-bgt-defence.de

ABSTRACT

The miniaturization of initiation chain components in regard to their explosive load still capable to initiate sufficiently inline components (transmitters, boosters) was determined to be more than an imperious task only few years ago. Based on the increasing knowledge on the behaviour of insensitive explosives including their detonic restrictions one part of several studies was determined for the assessment of minimized explosive loads for a(n) (electric) detonator capable to initiate a high power output insensitive booster.
Introducing directed warhead design elements a detonator design resulted in a detonator explosive load of less than10 mg sufficiently initiating an insensitive booster which is capable to initiate main charges having a shock initiation threshold of at least 35 kbar.
These results accelerated the ongoing insensitive initiation chain component replacements significantly in cooperation with our company Junghans-FWT.

Figure 1: DBD Efforts on Insensitive Initiation Chain Components in Cooperation with Junghans-FWT

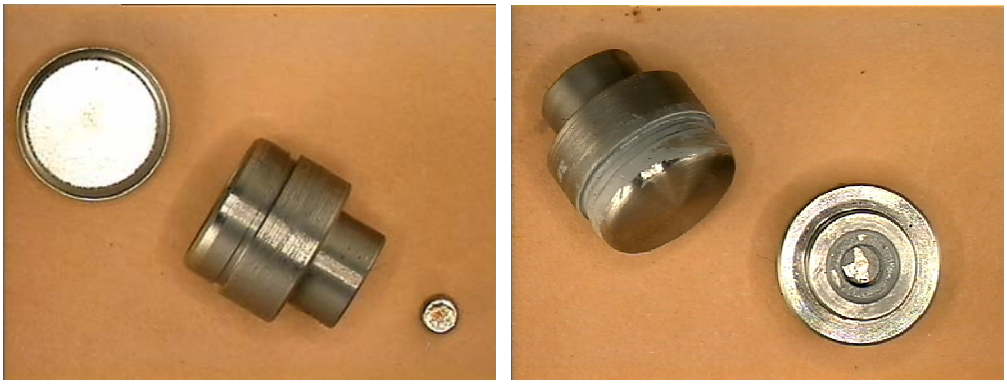

Figure 2: Special Emphasis Results on Miniaturized Electric Detonator and a Suitable Booster

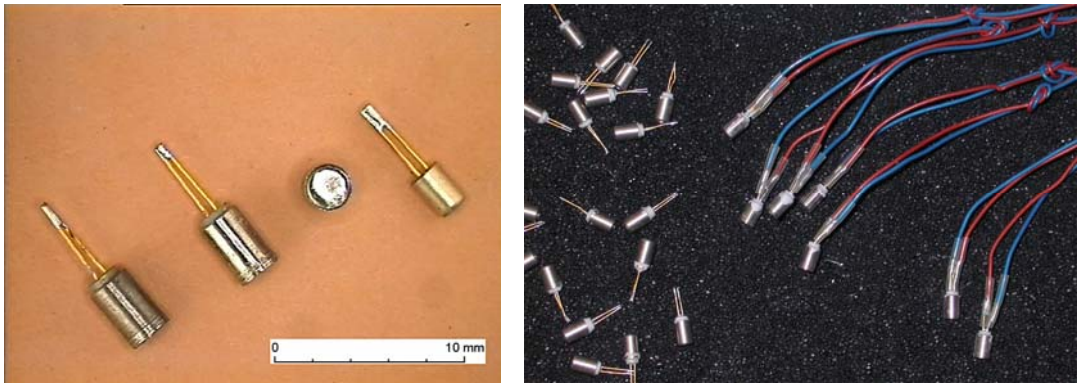

Figure 3: Special Emphasis Results on Miniaturized Electric Detonator and a Suitable Booster

Explosive Loads of Miniaturized Electric Detonator and Suitable Booster:

- Goal: Initiation of main IHE-loads having a critical diameter of up to 8 mm
- Detonator: 3 mg lead azide, output 5 mg HMX or a mixture of HMX / BTNNA
- Booster: Input 40 mg high density HNS, output 180 mg DXP 1340

Table 1: Booster Explosives Analyzed

Type	**HNS-HBD**	**DXP 1340**	**DXP 1340x**	**DXP 1380/1**
Mix	HNS 100	HMX / Hytemp 94 / 4	HMX / Hytemp / x 95.9 / 4 / 0.1	HMX / Hytemp 92 / 8
Density (g cm^{-3})	1.67	1.80	1.82	1.76
Gap-test (mm water)	15 / 13	15 / 12	13 / 12	14 / 12

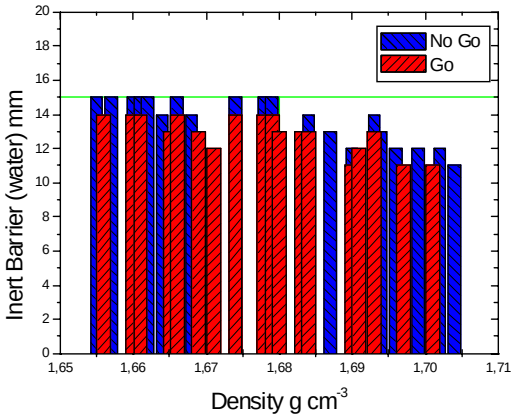

Figure 4: Gap Test Behaviour of HNS-HBD

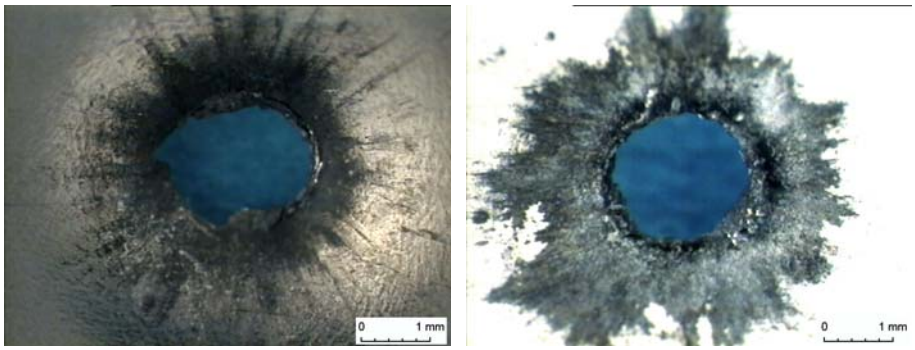

Figure 5: Ballistic Performance of the Miniaturized Detonator, left side 1 mm stand-off, right side 3 mm stand-off

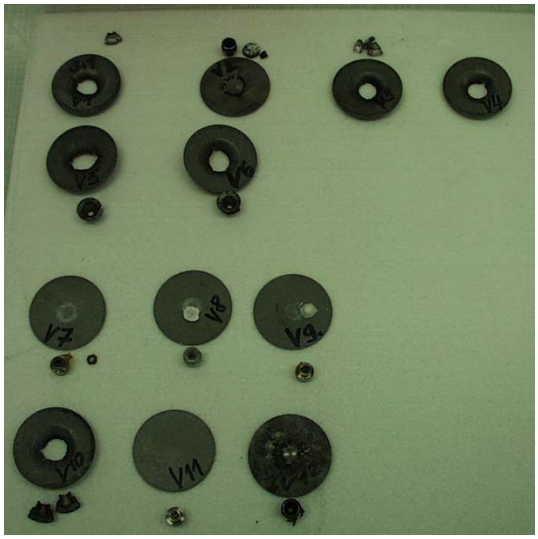

Figure 6: First Results of Miniaturized Initiation Chains

No Fire: 0.35 amp/300 sec
All Fire: 4.0 Volts
Function Fire:
>15/<20 Volts
Air Gap: >4 mm
V7-9: <critical diameter
V2, 11, 12: results specific to SMD resistor behaviour

(Electric Bridge: SMD-Resistor)

Ongoing Activities for Further Development and Qualification:

- Modification of miniaturized electric detonator to Cr-Ni-bridge: Current effort
- Prequalification: End of 2006
- Qualification: End of 2007