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SMALL-SCALE IMPACT SENSITIVITY TESTING ON EDC37

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Disclaimer

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ABSTRACT

EDC37 was tested at LLNL to determine its impact sensitivity in the LLNL's drop hammer system. The results showed that impact sensitivities of the samples were between 86 cm and 156 cm, depending on test methods.

Keywords: Explosives, impact sensitivity, drop hammer, EDC37

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1. Introduction

EDC37 is a plastic bonded explosive consisting of 90% HMX, 1% nitrocellulose and binder. We recently conducted impact sensitivity testing in our drop hammer system and the results are presented in this report.

2. System description and test method

Small-scale sensitivity testing was done to determine material response to various stimuli including impact, friction, and static spark. The impact sensitivity test system is briefly described below.

2.1 Impact sensitivity test (drop hammer) system at LLNL

ERL Type 12 drop hammer equipment at LLNL, shown in Figure 1, was used to determine the impact sensitivity [1]. The equipment includes a 2.5-kg drop weight, a striker (upper anvil, 2.5 kg for solid samples and 1.0 kg for liquid samples), a bottom anvil, a microphone sensor, and a peakmeter. For each drop, sample is placed on the bottom anvil surface and impacted by the drop weight from different heights. Signs of reactions upon impact are observed and recorded. These signs include noises, flashes or sparks, smoke, pressure, gas emissions, temperature rise due to exothermic reaction, color change of the sample, and changes to the anvil surface (noted by inspection). For solid samples, a "GO" was defined as a microphone sensor (for noise detection) response of $\geq$1.3 V as measured by a peakmeter. The higher the DH_{50} values, the lower the impact sensitivity. The method used to calculate DH_{50} values is the "up and down" or Bruceton method [2-3]. PETN and RDX have impact sensitivities of 15 and 35 cm, respectively. TATB has impact sensitivity more than 177 cm. For liquid samples, a "GO" was determined by the noise levels as measured by the peakmeter, appearance of flashes, temperature rise of the anvil, and visual inspection of the anvil surface. Figure 2 shows a "GO" event, flashes appeared as the drop weight impacted the sample.

2.2 Test methods

Three test methods are described in Table 1.

Table 1

Test method*	Description	Note
1	Sample was placed on a 1" square of carborundum sand paper (120 grit)	Thickness of the sand paper 432 μ, which is the standard method used at LLNL
2	Sample was placed on the bare bottom anvil surface without sample paper; greased top anvil surface and bottom anvil surface; grease layer thickness was 10 μ	Used Dow Corning silicone vacuum grease
3	Sample was placed on a 1" square of carborundum sand paper (120 grit), also adhered a 1" square of carborundum sand paper (120 grit) on the top anvil	Thickness of the sand paper 432 μ

* The tests were performed at ambient condition (72^{o}F, 40% R.H.) by the same technician.

Figure 1. Drop hammer system at LLNL

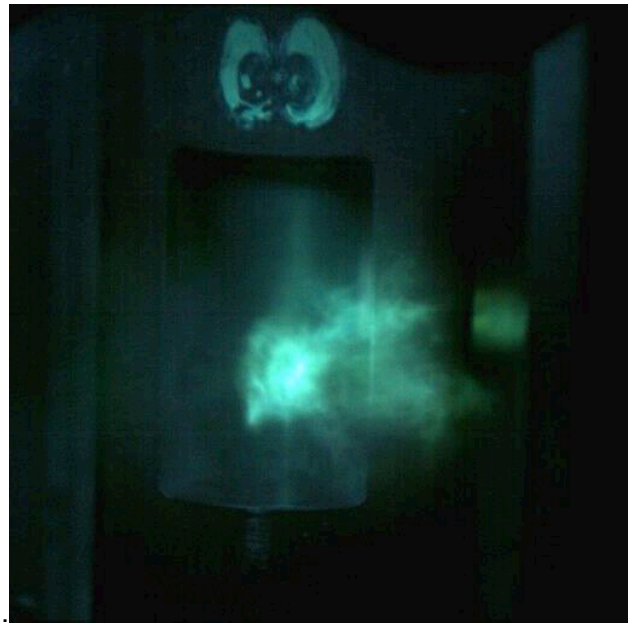

Figure 2. A “GO” event observed during the impact sensitivity test; flashes appeared as the drop weight impacted the sample.

3. Test results

Results of the impact sensitivity testing on EDC37 are listed in Tables 2, 3, and 4 for methods 1, 2, and 3, respectively. The impact sensitivities (DH_{50}) for EDC37 varied from 86 cm to 158 cm, depending on the test methods. The reason why by greasing the anvils and sand papering the top anvil increased the drop hammer value was not clear. One possible explanation is that by greasing, the EDC 37 particles were lubricated and hence the impact sensitivity was reduced (i.e. DH_{50} went up). More study is needed to draw more concrete explanation.

Table 2: DH_{50} (impact sensitivity for test method 1): 86 cm

Drop weight heights, cm	Number of "GO" events	Number of "NO-GO" events
50	0	3
62.9	2	4
79.2	4	1
99.7	1	0

Table 3: DH_{50} (impact sensitivity for test method 2; greased top and bottom anvils; no sand paper): 154 cm

Drop weight heights, cm	Number of "GO" events	Number of "NO-GO" events
111.9	0	3
125.6	4	4
140.9	4	4
158.1	4	2
177.4	2	3

Table 4: DH_{50} (impact sensitivity for test method 3; sand paper was placed on the top and the bottom anvils): 158 cm

Drop weight heights, cm	Number of "GO" events	Number of "NO-GO" events
111.9	0	3
125.6	4	4
140.9	4	4
158.1	4	2
177.4	2	3

References

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3. Dixon, W.J., "The Up and Down Method for Small Samples," J. Am. Statistical Assoc., 60, pp 967-978, 1965.