Reduced Sensitivity RDX (RS-RDX):
Effect of crystal quality on the shock sensitivity of a cast cured PBX formulation based on RS-RDX

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Presentation Outline

- Background
- RS-RDX developed by NIPPON KOKI Co., Ltd.
- Shock Sensitivity of PBX Formulations based on RS-RDX
- Effect of Crystal Shape on the Shock Sensitivity of PBX Formulation
- Conclusions
Background

- I-RDX® was “discovered” by SNPE in 1990’s.
- RS-RDX have been proposed by some manufacturers.
- RS-RDX crystals are high quality crystals.
- RS-RDX crystals have high density.
- Cast PBX formulation based on RS-RDX has less shock sensitivity than that based on standard RDX.
RS-RDX
- Morphology -

SEM photographs of RDX crystals

Standard RDX

RS-RDX

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Optical micrographs of RDX crystals in refractive index matched fluids

RS-RDX
- Crystal Density -

Standard RDX
1.794 g/cm³  1.800 g/cm³  1.804 g/cm³

RS-RDX
1.794 g/cm³  1.800 g/cm³  1.804 g/cm³

Density measurement of RDX crystals by the flotation method

## RS-RDX - Other Properties -

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RS-RDX</td>
</tr>
<tr>
<td>Melting point</td>
<td>DSC</td>
<td>202.5</td>
</tr>
<tr>
<td>HMX content</td>
<td>FT-IR</td>
<td>No detected</td>
</tr>
<tr>
<td>Impact sensitivity</td>
<td>Bruceton method (50% Point)</td>
<td>40.4 cm</td>
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<tr>
<td></td>
<td>5-Kg Drop Hammer</td>
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</tr>
<tr>
<td>Friction sensitivity</td>
<td>BAM friction Test (1/6 Point)</td>
<td>58.8 78.5 N</td>
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</table>
## Shock Sensitivity of PBX Formulations based on RS-RDX

### PBX Formulations

<table>
<thead>
<tr>
<th></th>
<th>RDX</th>
<th>Al</th>
<th>AP</th>
<th>Binder</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBXN-109</td>
<td>64%</td>
<td>20%</td>
<td>43%</td>
<td>16%</td>
</tr>
<tr>
<td>PBXN-111</td>
<td>20%</td>
<td>25%</td>
<td>43%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Al: Aluminum, AP: Ammonium Perchlorate

### RDX Particle Size

<table>
<thead>
<tr>
<th></th>
<th>Granulation</th>
<th>Weight ratio of RDX</th>
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</thead>
<tbody>
<tr>
<td>RS-RDX</td>
<td>Class A( )</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>Class E( )</td>
<td>30%</td>
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</tbody>
</table>

ML-R-398

Large Scale Gap Test

Electric Detonator

Melt-Cast Pentlite (50/50)

Card Gap (PMMA)

Steel Tube (38.4mmI.D, 48.6mmO.D)

Test Charge (PBX)

Witness Plate (t=10mm)

140mm
Shock Sensitivity of PBXN-109

Results of LSGT (50% point) for PBXN-109


Shock Sensitivity of PBXN-111

Results of LSGT (50% point) for PBXN-111

Effect of Crystal Shape on the Shock Sensitivity of PBX Formulation

Spherical RS-RDX

SEM images
Optical micrographs

Crystal Density

1.794 g/cm³
1.800 g/cm³
1.804 g/cm³

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Effect of Crystal Shape on the Shock Sensitivity of PBXN-109

Results of LSGT (50% point) for PBXN-109
Conclusions

(1) RS-RDX crystals were high quality crystals which had virtually no impurities and internal defects in their crystal.

(2) RS-RDX crystals had higher density than standard RDX crystals.

(3) PBXN-109 and PBXN-111 formulations based on RS-RDX were much less sensitive than those based on standard RDX.

(4) RS-RDX developed by NIPPON KOKI CO., LTD. had properties similar to RS-RDX produced by other manufacturers.

(5) The shock sensitivity of PBX formulation could be improved by controlling not only the crystal quality but also the crystal shape of RS-RDX.
Thank you for your attention!