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

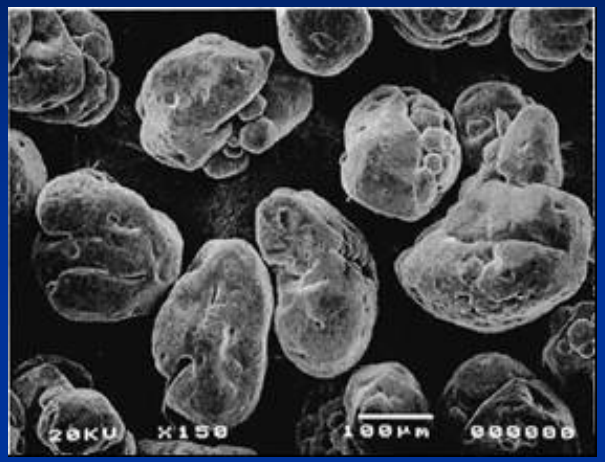
- ✓ Background
- ✓ RS-RDX developed by NIPPON KOKI Co., Ltd.
- ✓ Shock Sensitivity of PBX Formulations based on RS-RDX
- ✓ Effect of Crystal Shape on the Shock Sensitivity of PBX Formulation
- ✓ Conclusions

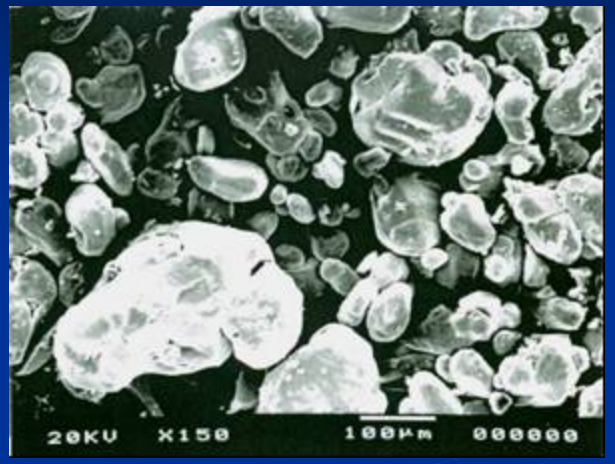
Background

- 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.

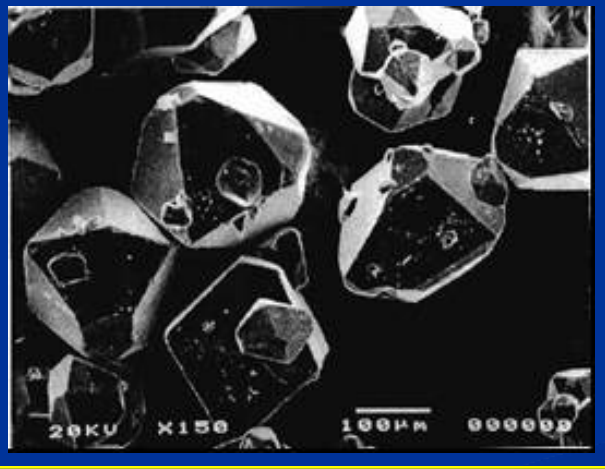
RS-RDX
- Morphology -

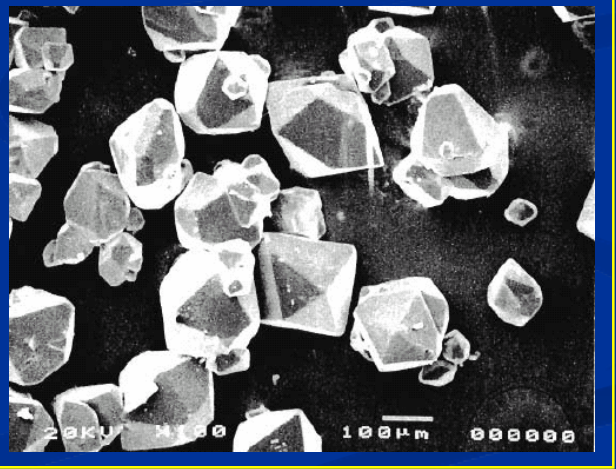
Standard RDX





RS-RDX

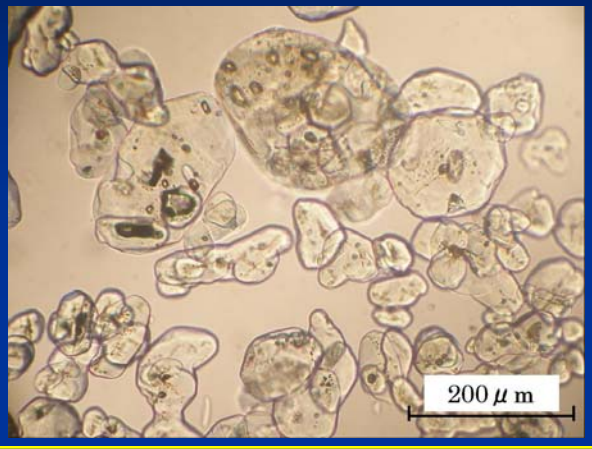


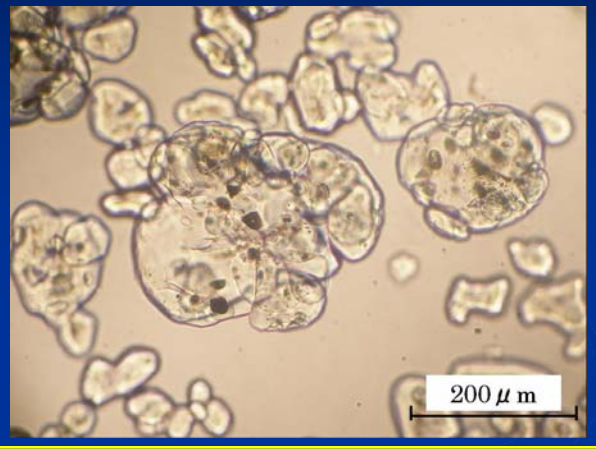


SEM photographs of RDX crystals

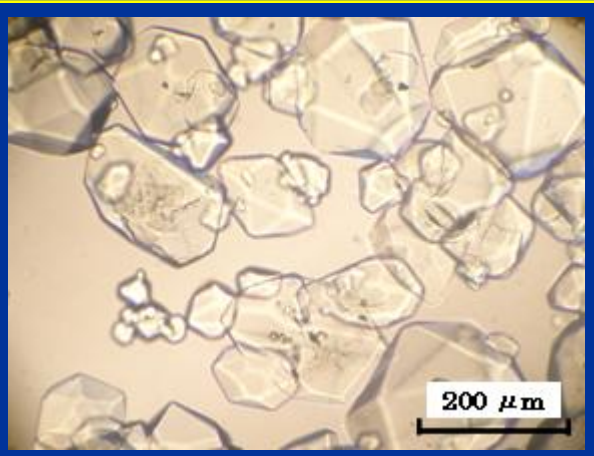
RS-RDX
- Internal defect -

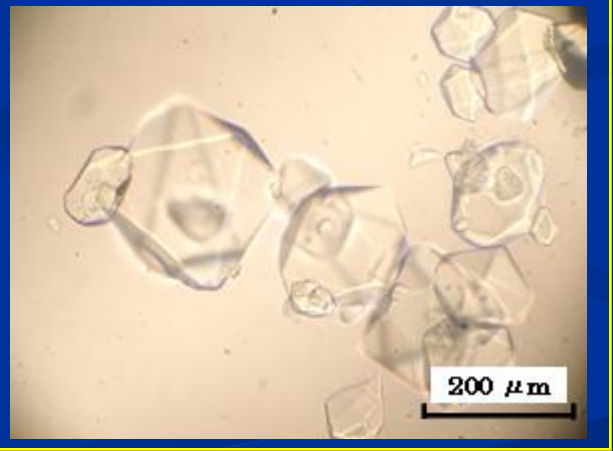
Standard RDX





RS-RDX

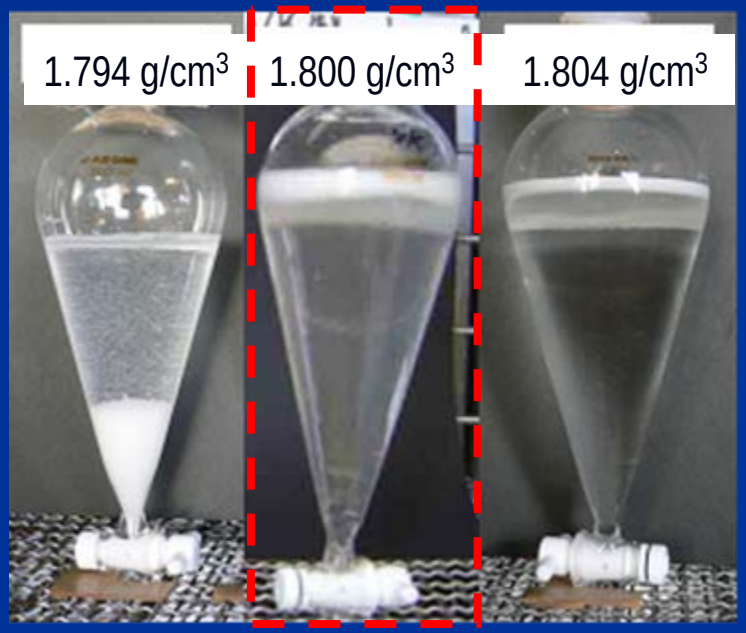




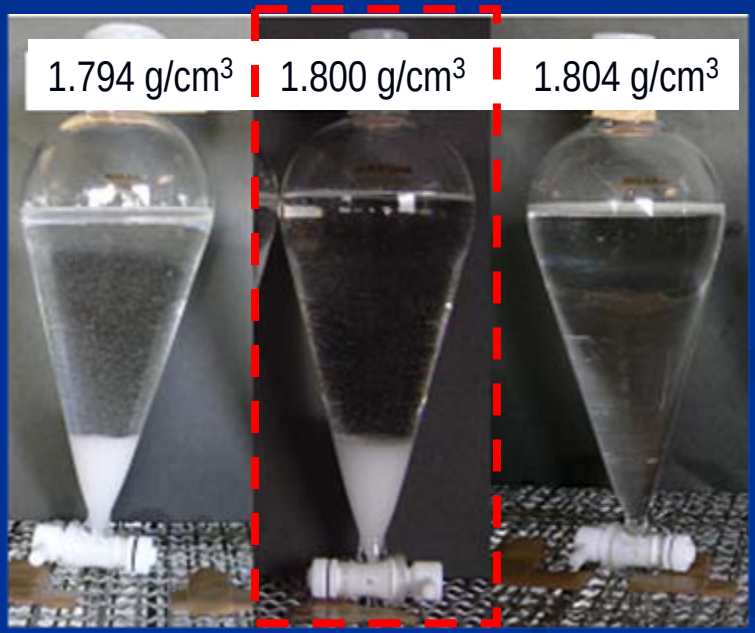
Optical micrographs of RDX crystals in refractive index matched fluids

RS-RDX
- Crystal Density -

Standard RDX



RS-RDX



Density measurment of RDX crystals
by the flotation method

RS-RDX
- Other Properties -

Property	Test Method	Results	
		RS-RDX	Standard RDX (type□)
Melting point	DSC	202.5 □	203.7 □
HMX content	FT-IR	No detected	No detected
Impact sensitivity	Bruceton method (50% Point) 5-Kg Drop Hammer	40.4 cm	34.7 cm
Friction sensitivity	BAM friction Test (1/6 Point)	58.8□78.5 N	58.8□117.7 N

Shock Sensitivity of PBX Formulations based on RS-RDX

PBX Formulations

	RDX	Al	AP	Binder
PBXN-109	64%	20%	□	16%
PBXN-111	20%	25%	43%	12%

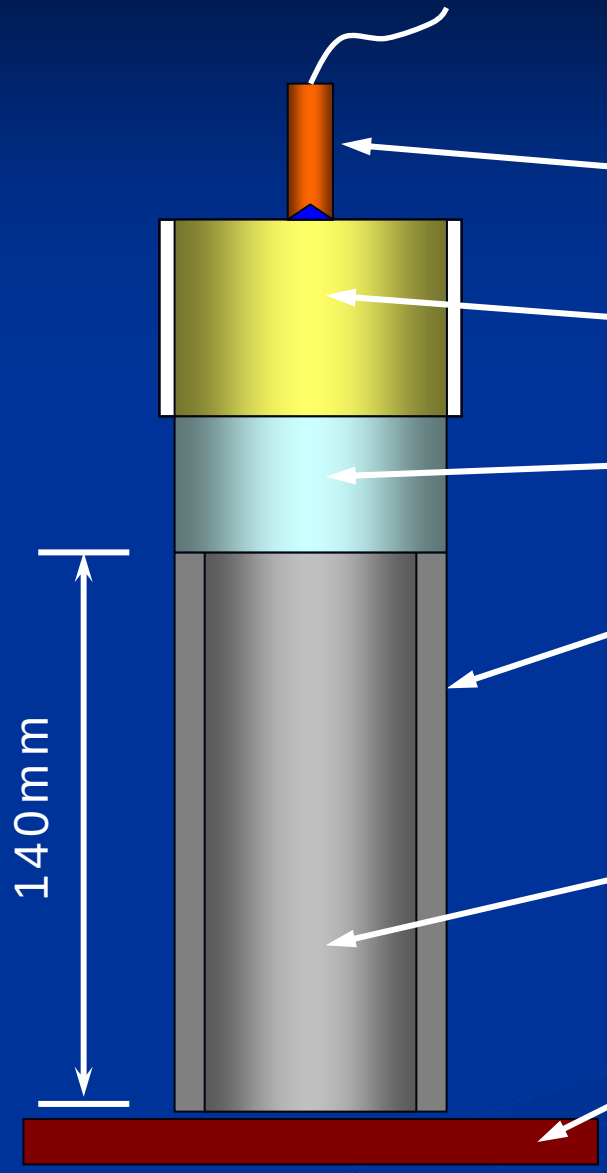
Al:Aluminum, AP:Ammonium Perchlorate

RDX Particle Size

	Granulation	Weight ratio of RDX
RS-RDX	Class A(□)	70%
	Class E(□)	30%

□MIL-R-398

Large Scale Gap Test



Electric Detonator

Melt-Cast Pentlite (50/50)

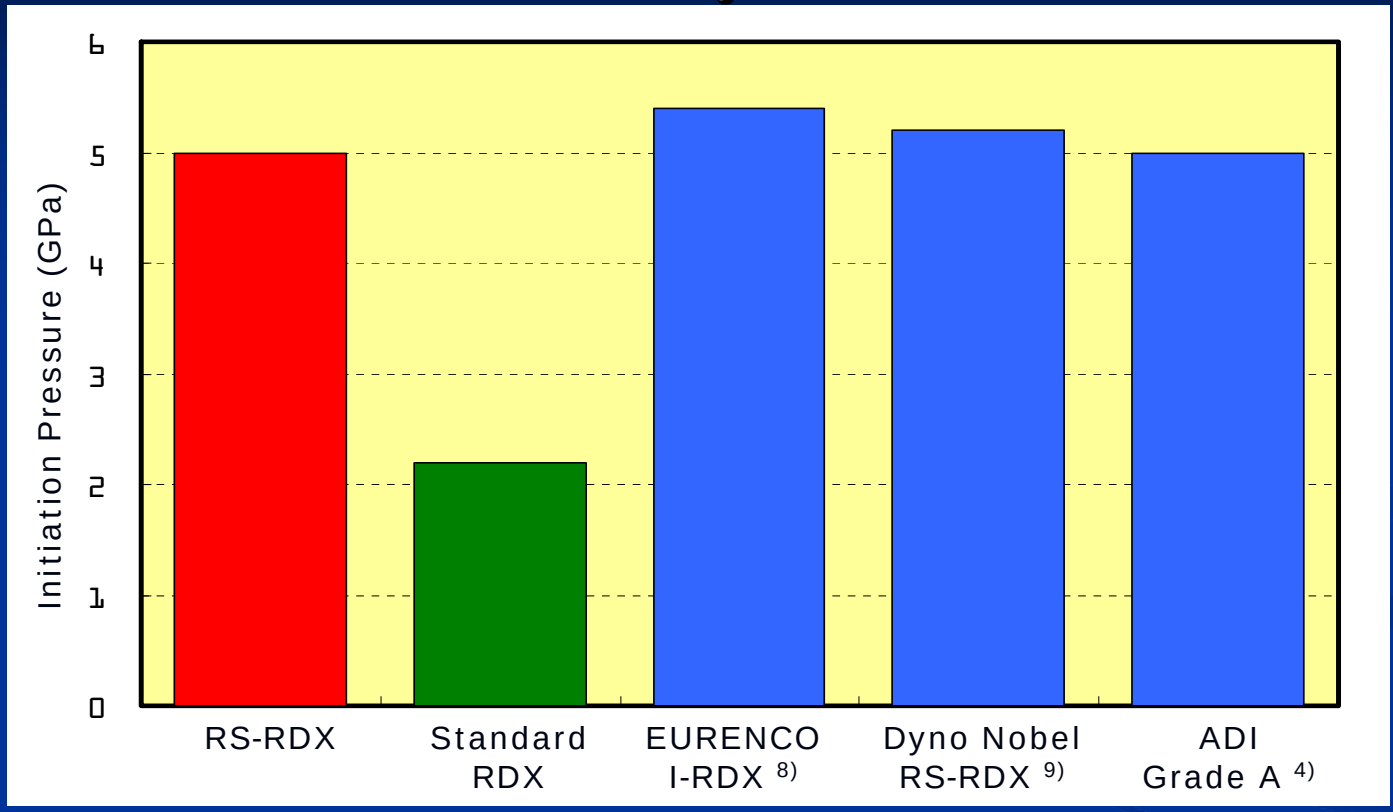
Card Gap (PMMA)

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

Test Charge (PBX)

Witness Plate
(t=10mm)

Shock Sensitivity of PBXN-109



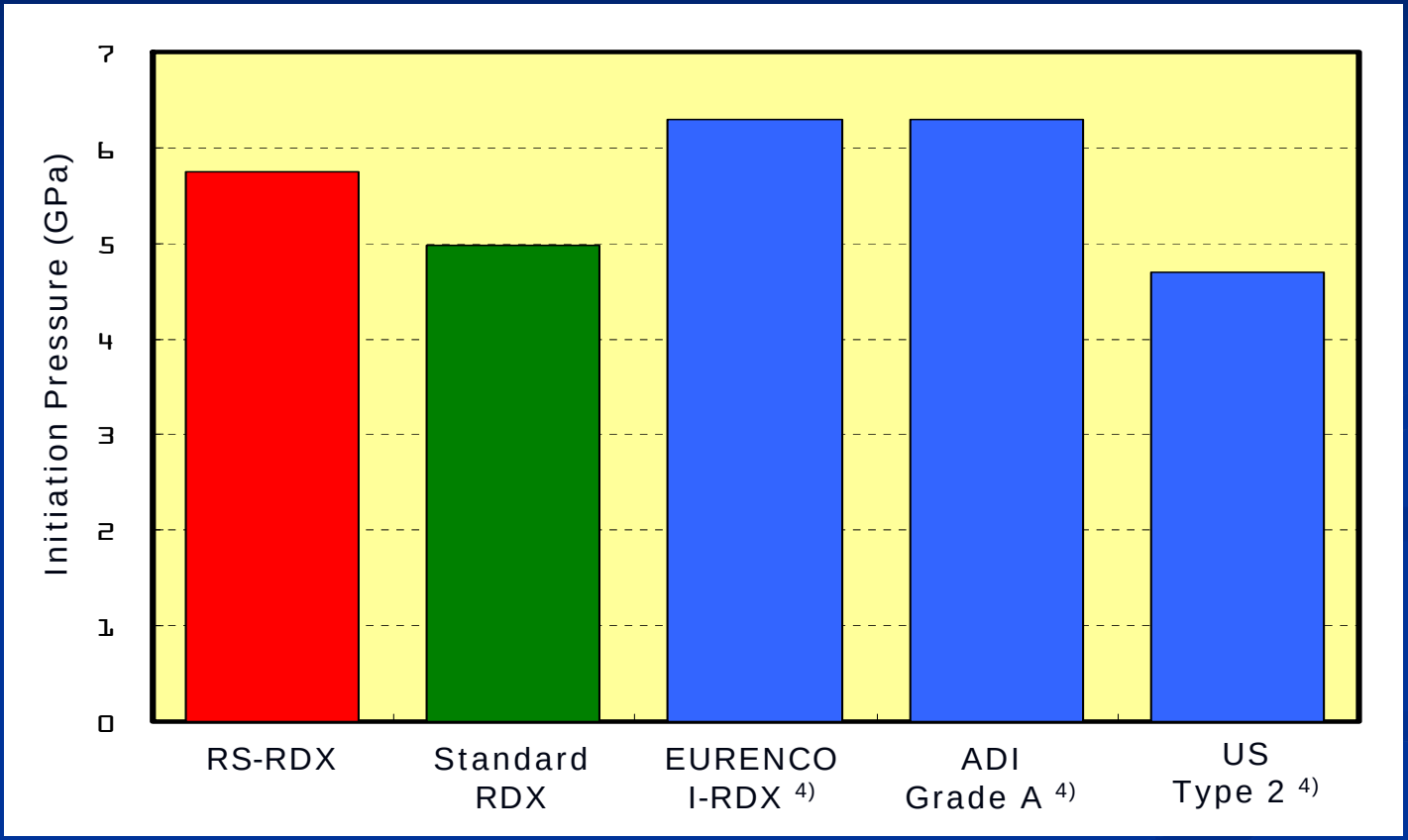
Results of LSGT (50% point) for PBXN-109

4) Ian J. Lochert, Marl D. Franson and Brian L.Hamshere, Assessment of Australian Insensitive RDX, Proceedings of IM & EM Technology Symposium, Orlando FL, March 2003.

8) C. Spyckerelle, A. Freche and G. Eck, Ageing of reduced sensitivity RDX and compositions based on reduced sensitivity RDX, an update, Proceedings of IM & EM Technology Symposium, Bristol UK, 2006.

9) Neal Lundwall, Que Bui-Dang, Brian Hays and Kelly Minnick, Reduced Sensitivity Cyclotrimethylene Trinitramine (RDX) Evaluation, Proceeding of IM & EM Technology Symposium, San Francisco CA, 2004.

Shock Sensitivity of PBXN-111



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

4) Ian J. Lochert, Marl D. Franson and Brian L.Hamshere, Assessment of Australian Insensitive RDX, Proceedings of IM & EM Technology Symposium, Orlando FL, March 2003.

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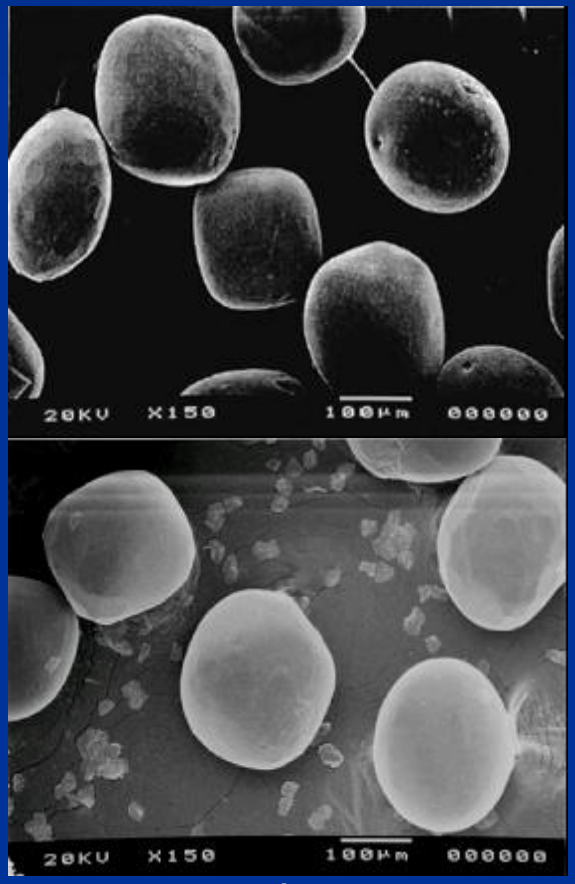
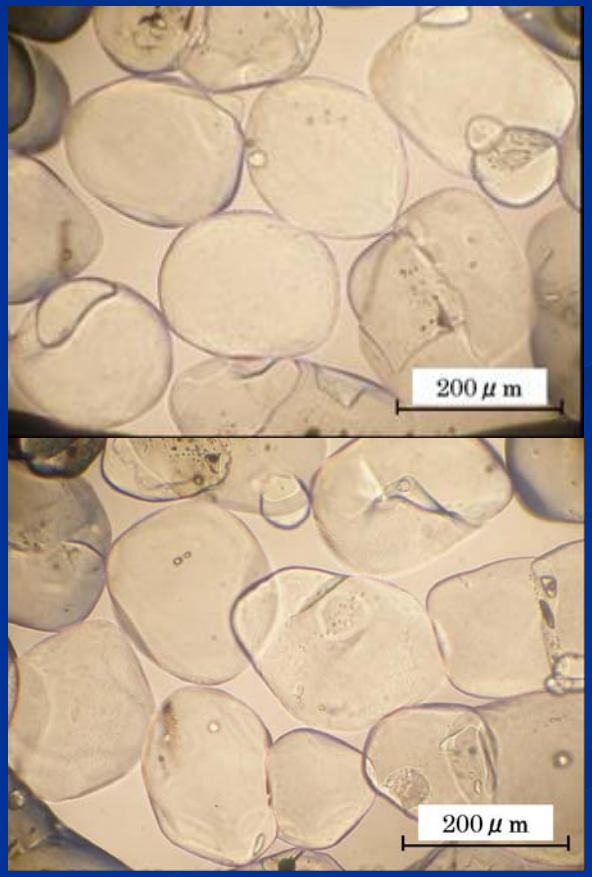
Research Development Div.

Effect of Crystal Shape on the Shock Sensitivity of PBX Formulation

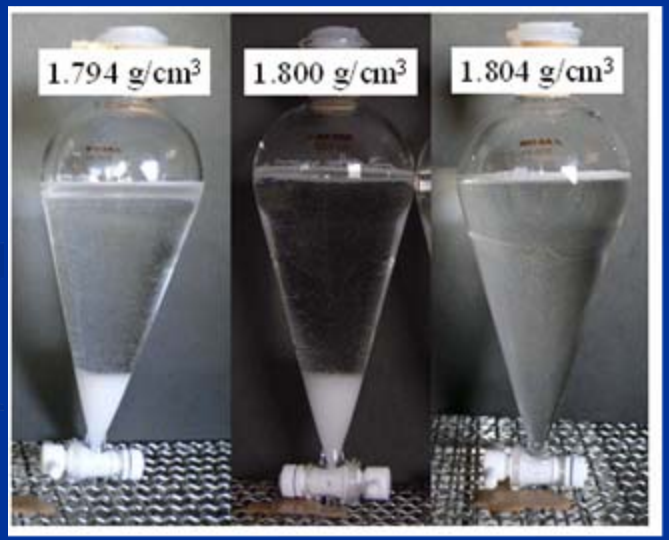
Spherical RS-RDX



SEM images

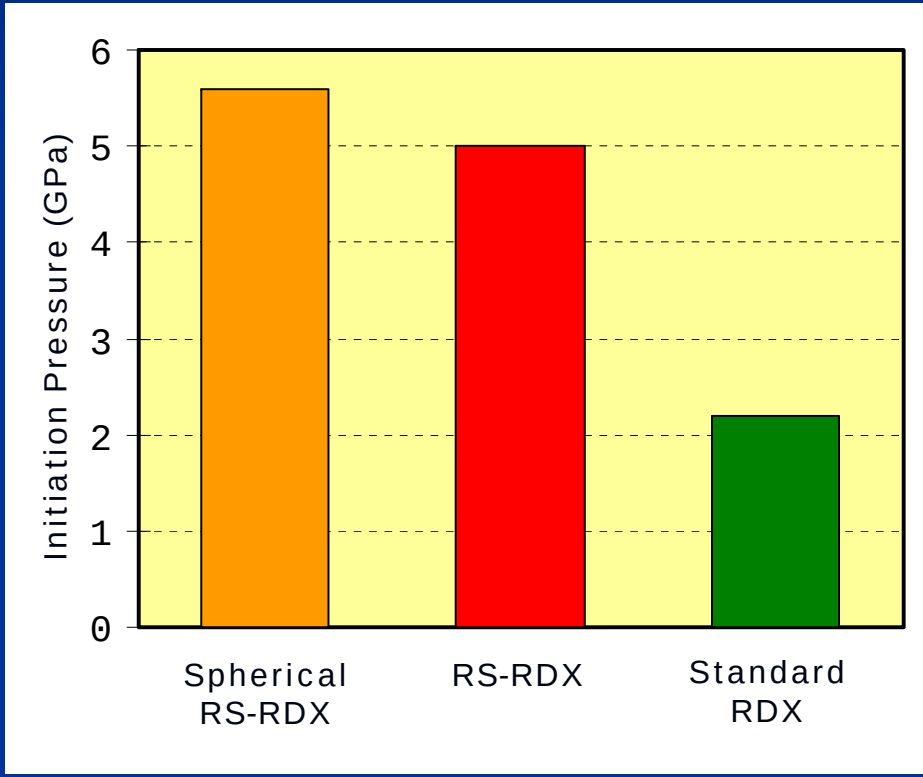


Optical micrographs



Crystal Density

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



Type of RDX	Initiation Pressure (GPa)
Spherical RS-RDX	5.6
RS-RDX	5.0
Standard RDX	2.2

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!