

Arthur Provatas



Australian Government
Department of Defence
Defence Science and
Technology Organisation

WEAPONS SYSTEMS DIVISION

Australian Melt-Cast Explosives R&D

DNAN – A Replacement for TNT in Melt-Cast Formulations

Arthur Provatas & Phil Davies

Explosives & Pyrotechnics Group
Weapons Systems Division, DSTO



Presentation Summary

- DNAN properties
- Basic hazards characterisation of DNAN and simple formulations
- Shock sensitivity (UN Series 2 Gap Test / LSGT) of DNAN and simple formulations
- Performance studies



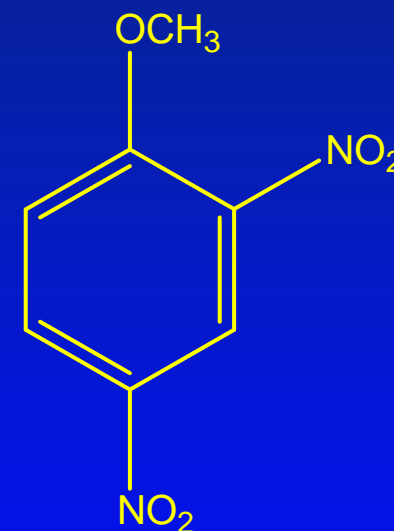
Introduction

Potential use of DNAN as possible TNT replacement in melt-cast fills.

DNAN offers potentially lower toxicity and sensitivity over TNT.

Performance is ~10% less TNT but less sensitive to impact.

DG Class 4.1 Flammable Solid



DNAN



Vacuum Thermal Stability Testing

Mixtures (50/50 w/w)	Gas evolution, ml/g
DNAN/RDX	0.06
DNAN/MNA	0.07
DNAN/TNT	0.06, formation of red liquid
RDX/MNA	0.12



Hazards Properties

Material	Fol, Evolved gas, cm ³	Friction, N	ESD, J
DNAN	>220	160	-
DNAN + grit	>220	-	-
TNT – flake	170	216	4.5
RDX – ADI	80	96	4.5
ARX-4027*	160	108	4.5
Comp B	140	80	4.5

* 60/40 RS-RDX/DNAN

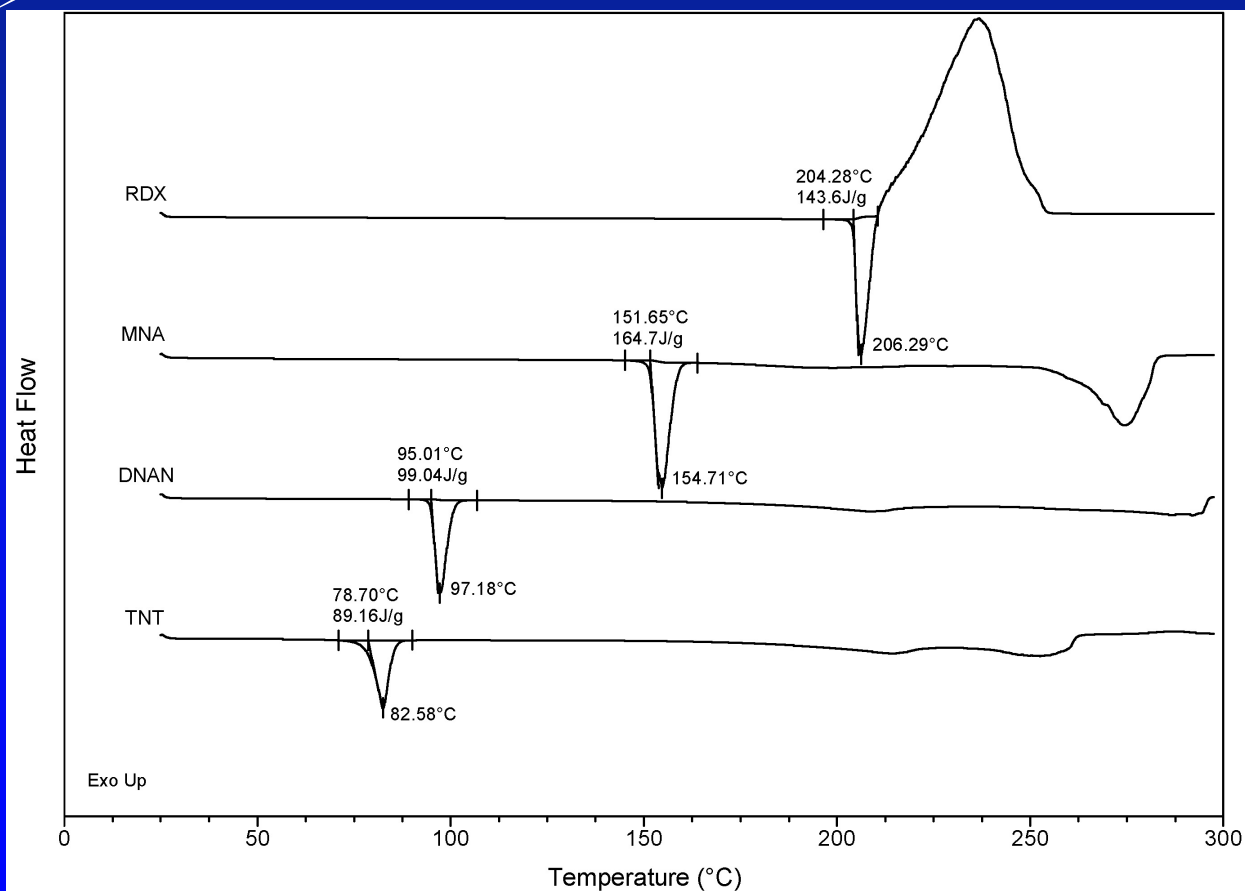


Temperature of Ignition Results

Material	T of I, °C
DNAN	347
MNA	290-370
RDX – ADI	219
RDX – DYNO	212
ARX-4027 (60/40 RDX/DNAN)	220
TNT	306
DNAN/RDX (1:1)	211
MNA/RDX (1:1)	201
DNAN/TNT (1:1)	266

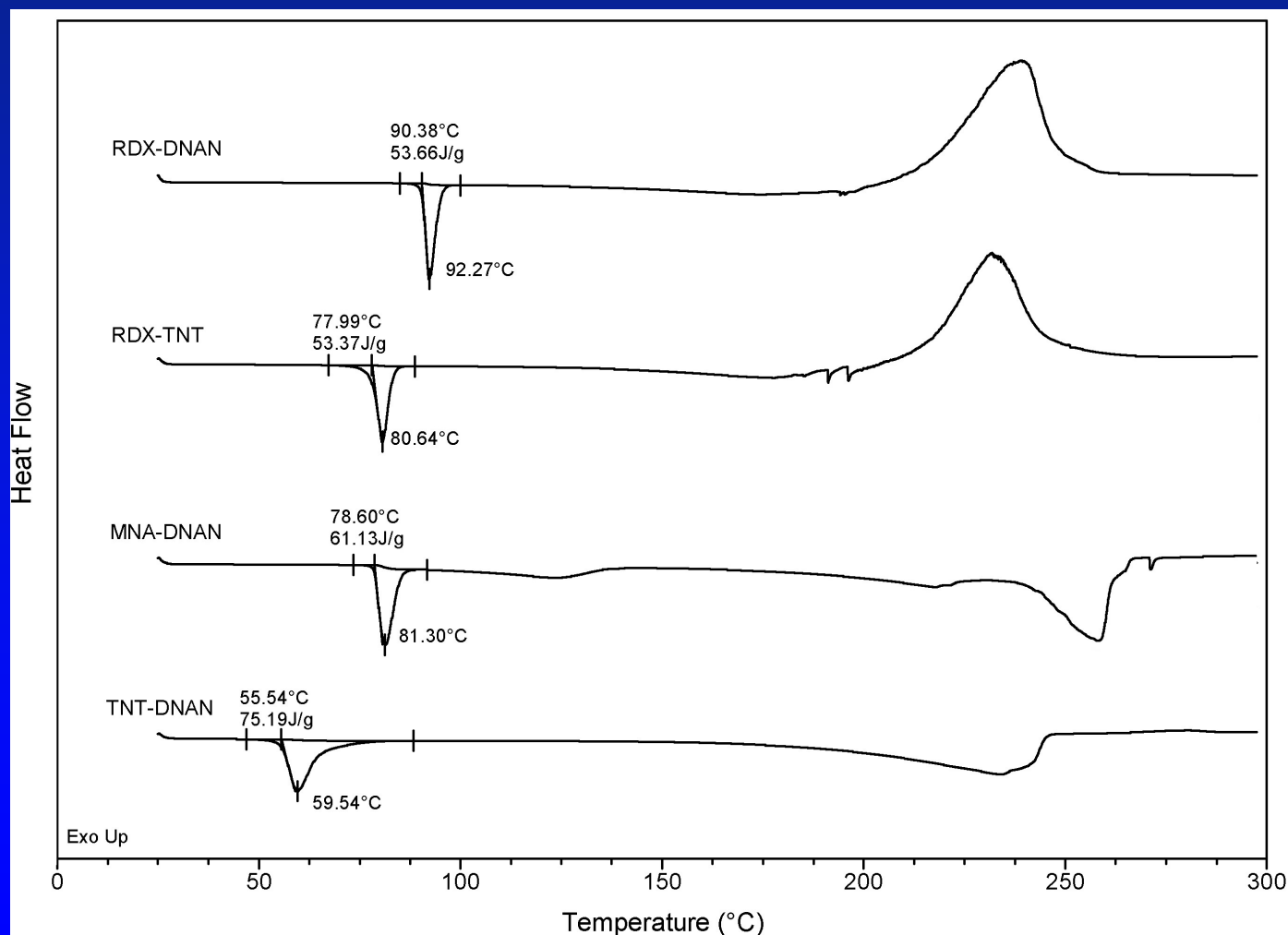


Thermal Analysis



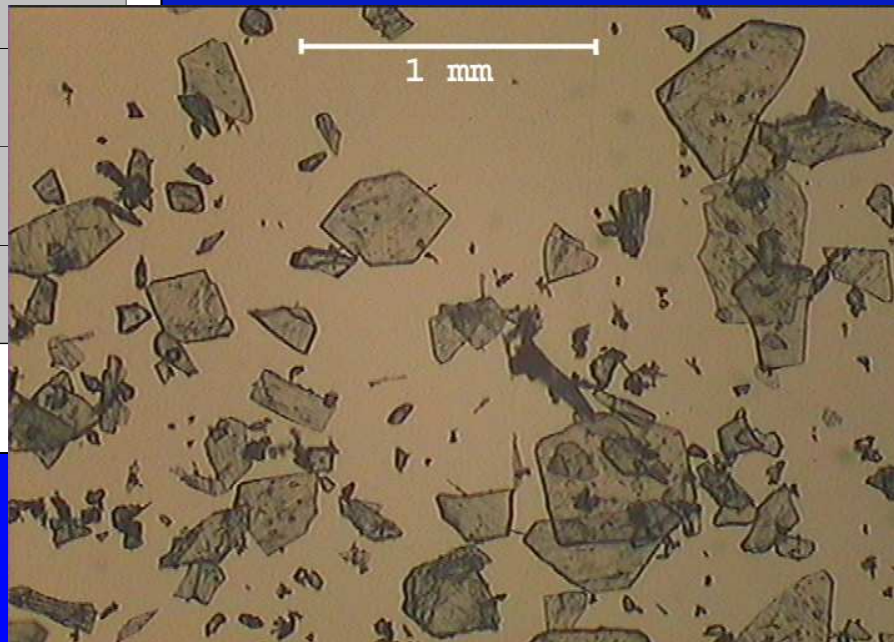
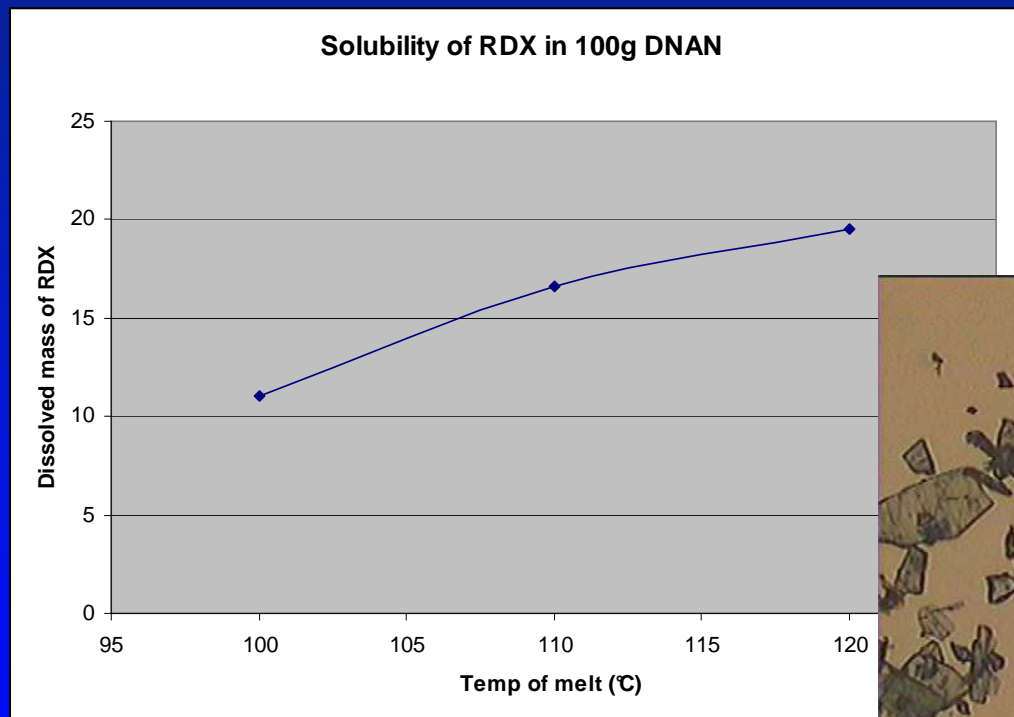


Thermal Analysis



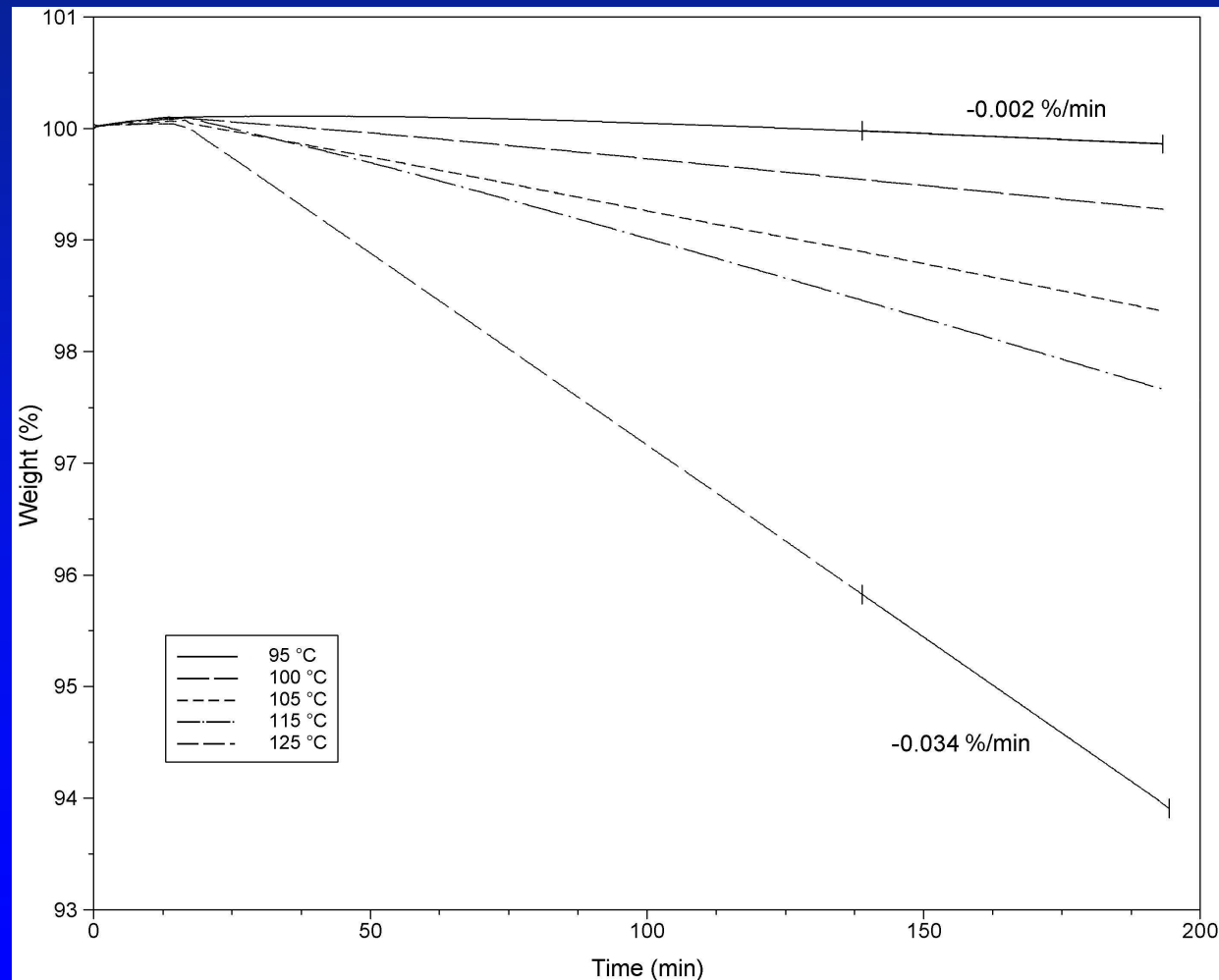


Solubility of RDX in DNAN





Sublimation/evaporation determination



Determined via
Isothermal-TGA

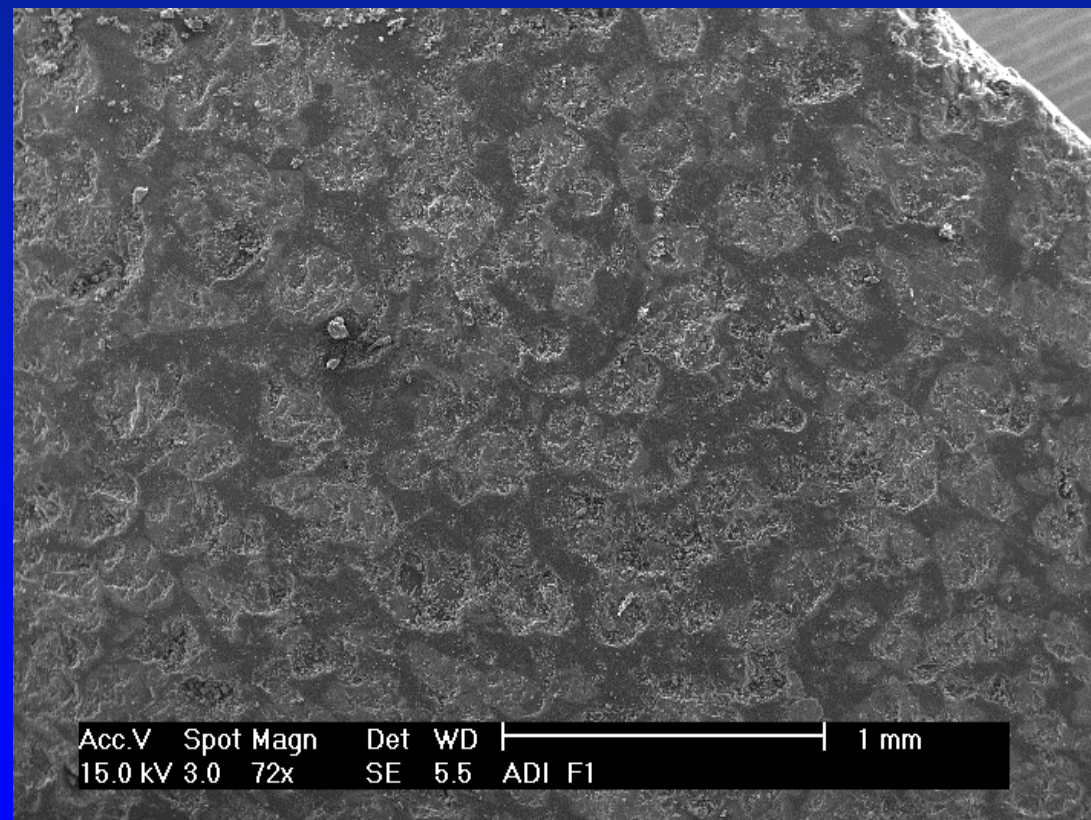
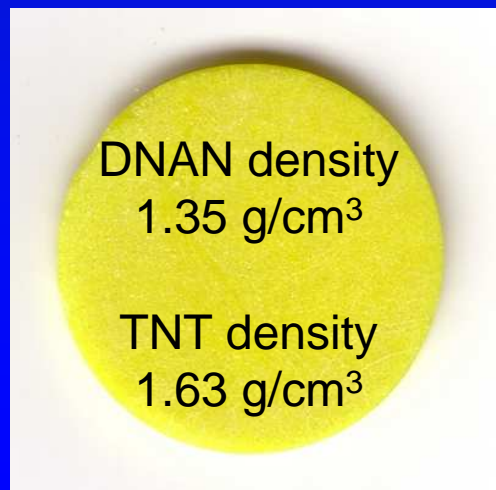


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ARX-4027

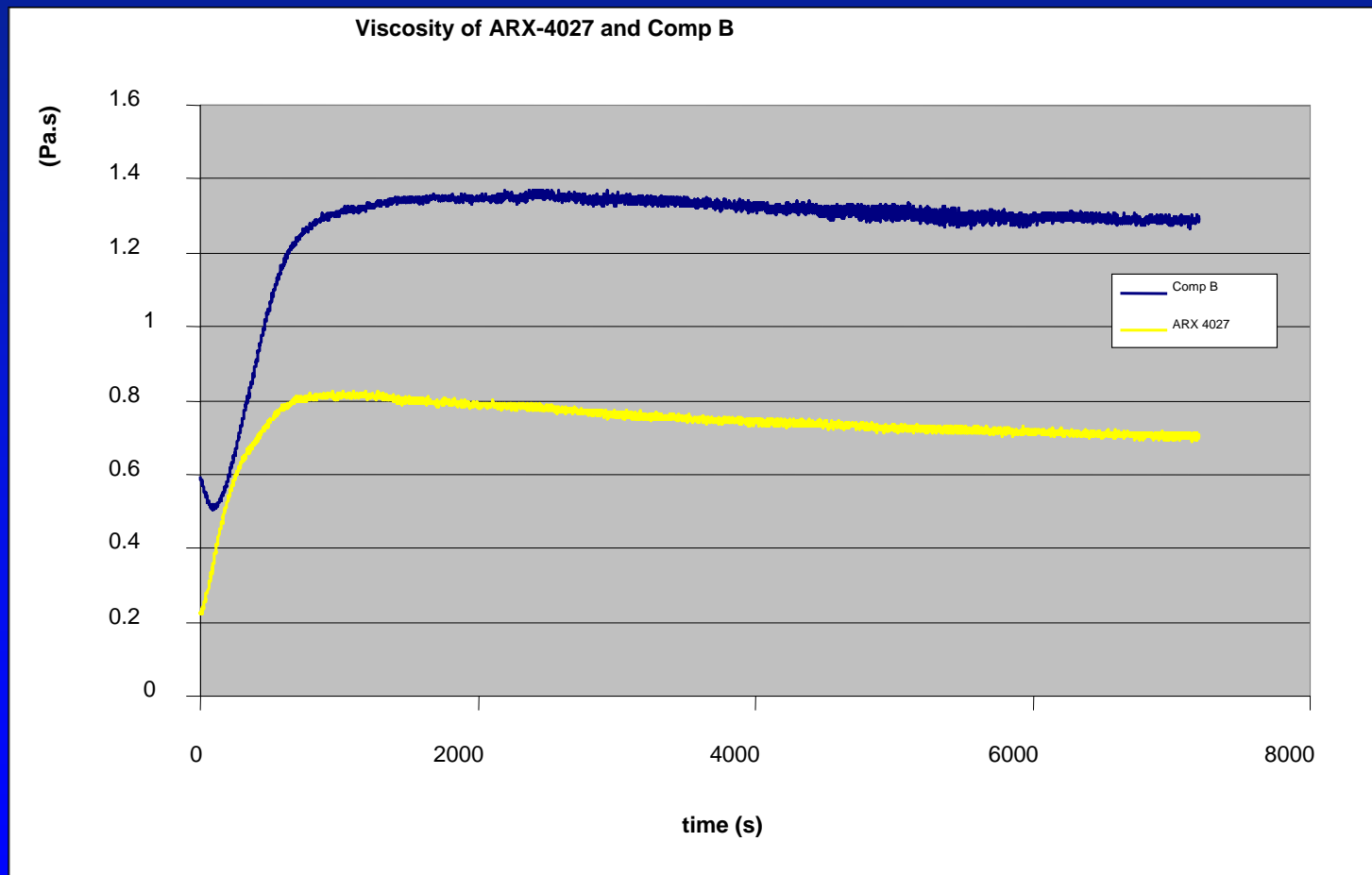
60/40 RDX/DNAN (+0.25% MNA)

Two variants made:
RS-RDX & Dyno RDX





Viscosity of ARX-4027

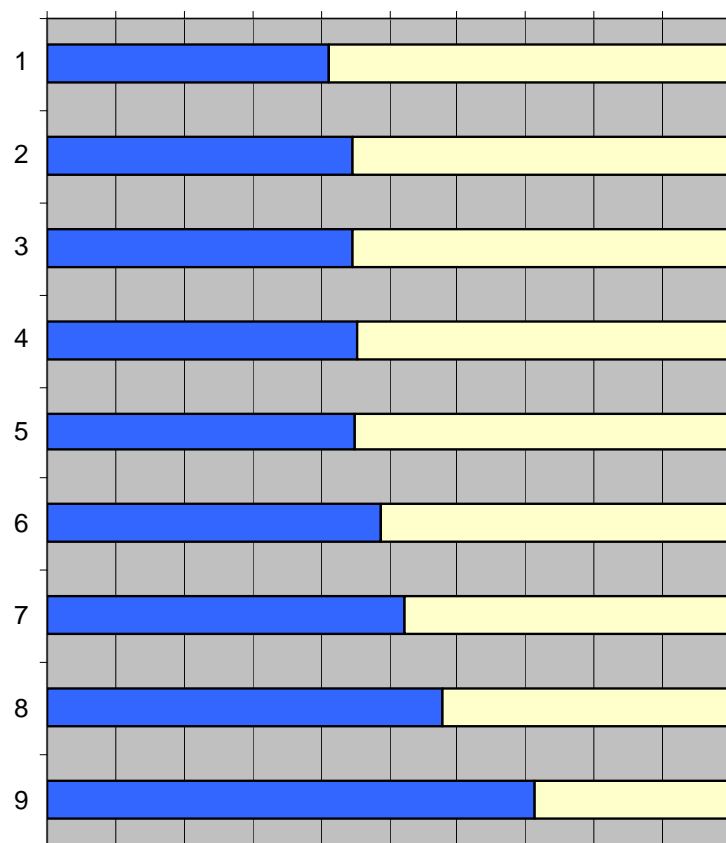




RDX Settling in DNAN

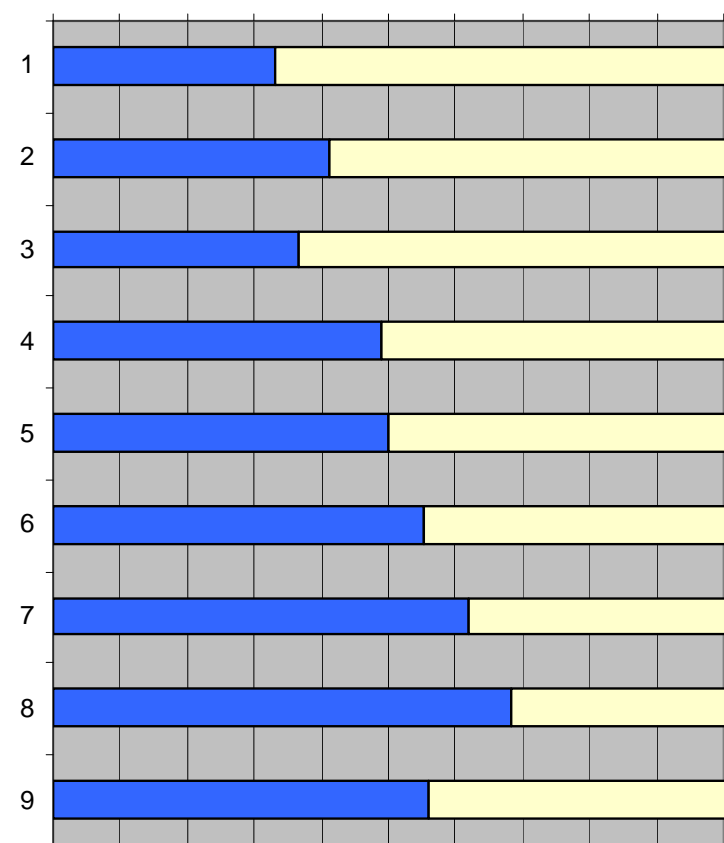
% RS-RDX

50% 52% 54% 56% 58% 60% 62% 64% 66% 68% 70%



% Dyno RDX

50% 52% 54% 56% 58% 60% 62% 64% 66% 68% 70%





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Shock Sensitivity of ARX-4027

- UN Series 2 Gap Test
- LSGT





Shock Sensitivity of ARX-4027

Material	Gap (mm/cards)	GPa
DNAN	18 / 71	7.02
ARX-4027 (DYNO)	47/184	2.62
ARX-4027 (ADI)	51/202	2.24
Comp. B	46/181	2.69
PBXN-109	28/196	5.02



Detonative Performance

Melt-Cast Formulation	Exp. VoD m/s	Calc. VoD m/s
DNAN	>1" crit. dia.	5344
ARX-4027 M1	7850	7300
ARX-4207 M2	7790	7300
Comp B	7860	7630



Summary

- DNAN is promising in terms of sensitivity and physical properties
- Questions over 4.1 status – depends on transport configuration?
- Initial test formulations reveal RS-RDX sensitivity is not retained.
- High mass% loadings of RDX possible by virtue of low DNAN density.