INCREASED IMPULSE OF SOLVENTLESS EDB ROCKET PROPELLANT

- by addition of high explosives RDX and FOX-7

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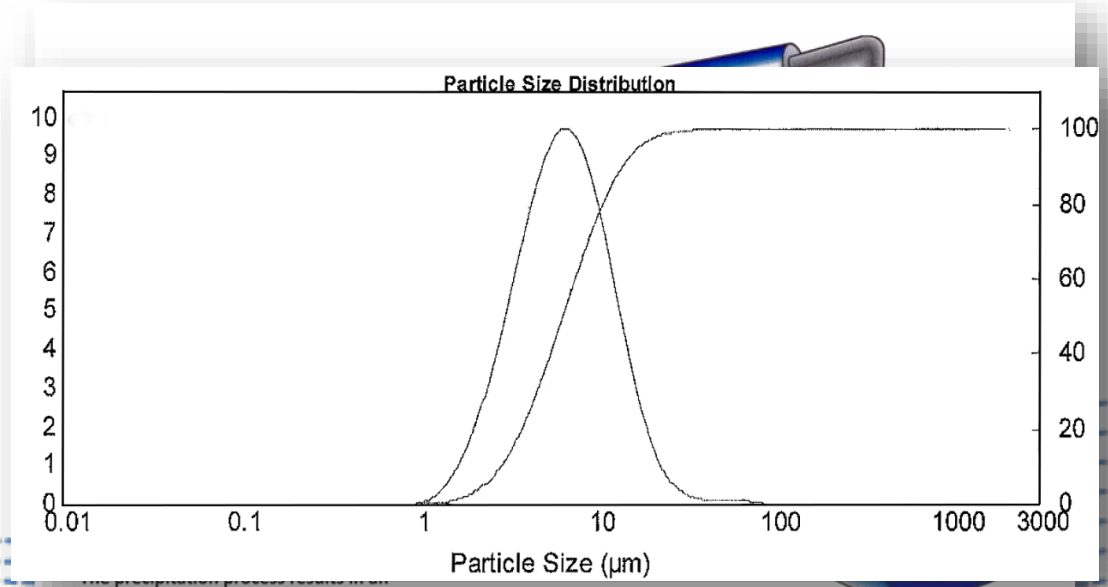
Objective

- Test addition of high explosives
  - Small size RDX and FOX-7

	RDX About 6 microns	FOX-7 About 12 microns	Specific Impulse (Ns/kg) Expansion 70 to 1 bar
Test no 1	0	0	*2326*
Test no 2	5	0	*2335*
Test no 3	10	0	*2344*
Test no 4	15	0	*2352*
Test no 5	0	5	*2335*
Test no 6	0	15	*2352*

RDX - Hexogen

- Propellant grade RDX
  - Particle size around 5 microns
  - Normal hexogen together with NC and additives
  - Precipitated with an ejector process



FOX-7 - DADNE

- ”Propellant grade” FOX-7
  - Particle size around 10 microns
  - Optimized parameters to produce smaller particles
    - > **Faster feeding rates**
  - Less sensitive

ERL drop hammer FOX-7

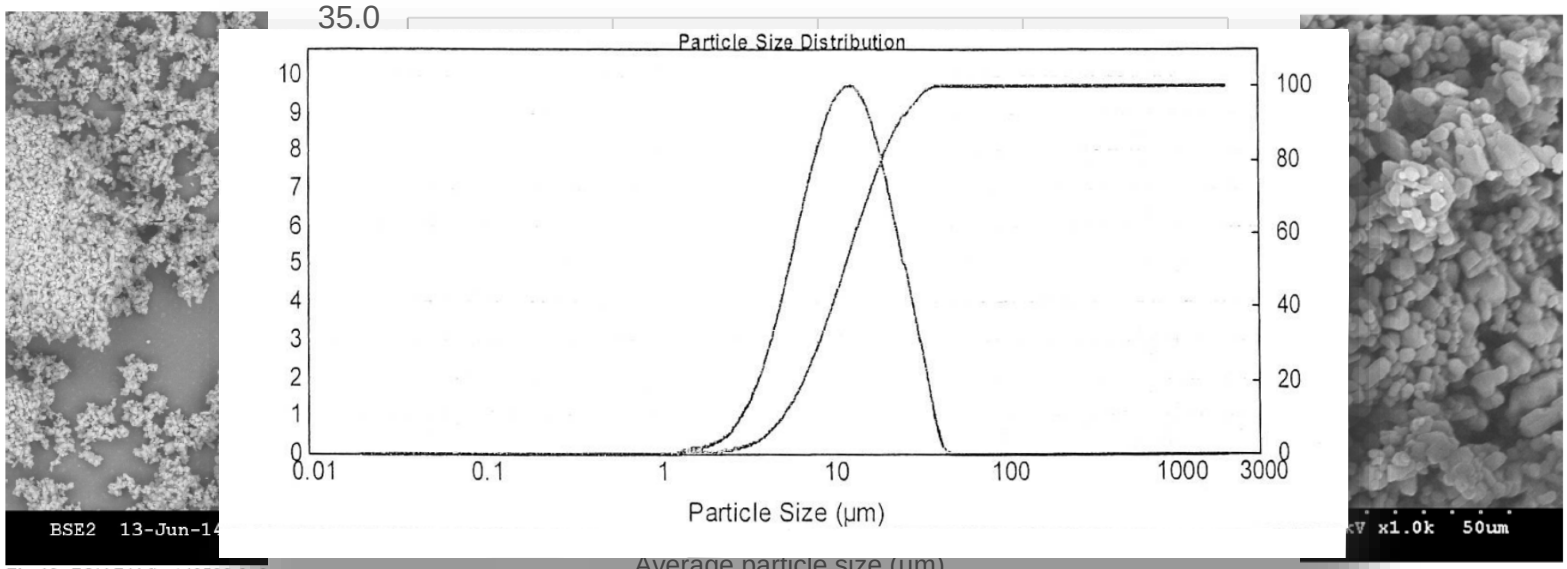


Fig 13. *FOX 7 X-fin 140528:2, 2*

FOX-7 - DADNE

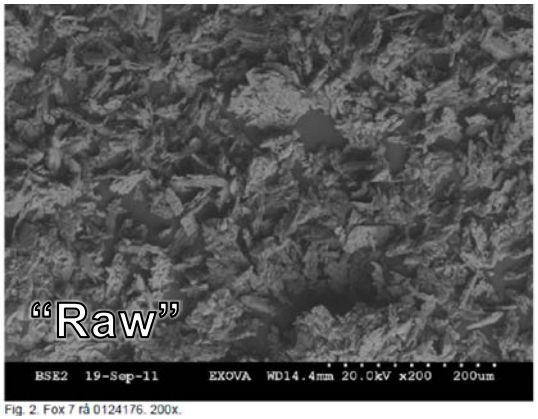


Fig. 2. Fox 7 rå 0124176. 200x.

Fig 13. *FOX 7 X-fin 140528:2, 200x magnification.*

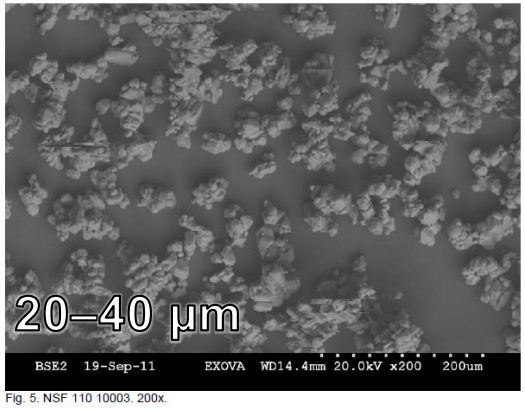


Fig. 5. NSF 110 10003. 200x.

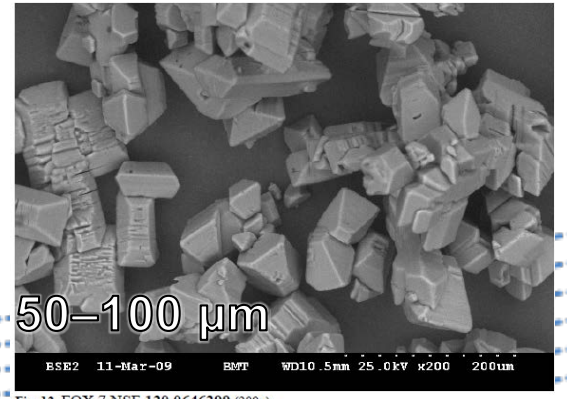


Fig. 12. FOX 7 NSF **120 0646299** (200x).

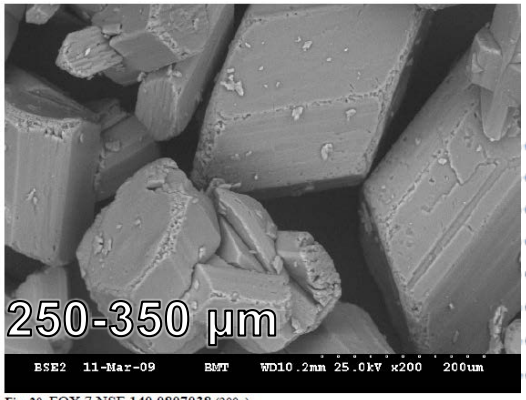
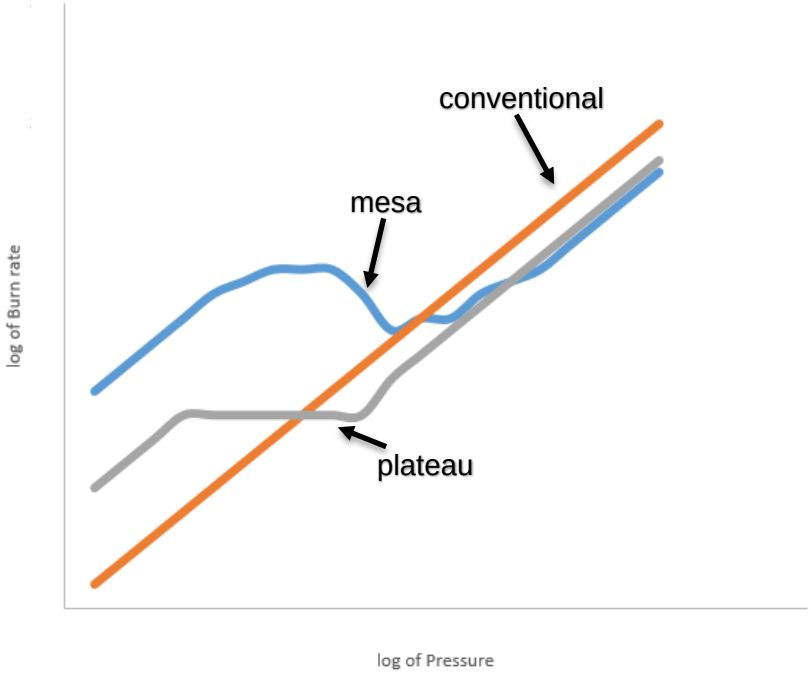


Fig. 20. FOX 7 NSF **140 0807038** (200x).

Combustion theory

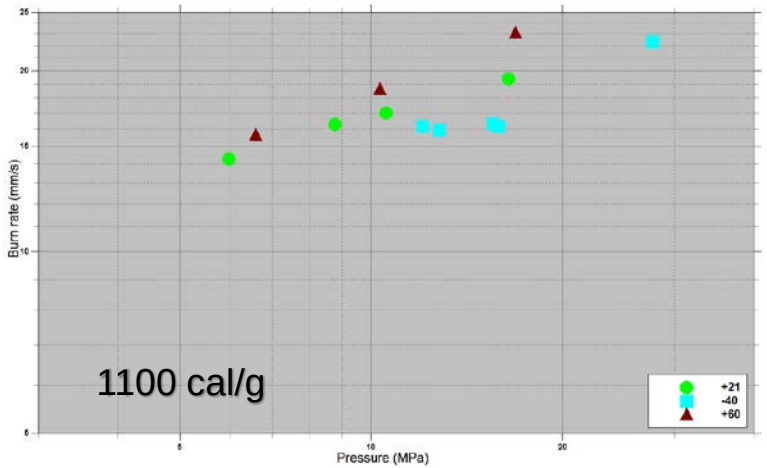
- Super-rate burning

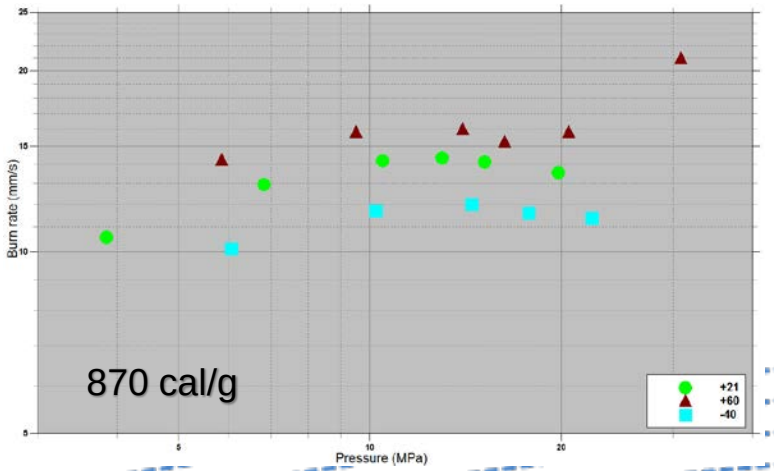
$$r = a * P^n$$



Lead-free base composition

- High energy content (1100 cal/g)
  - Low super-rate burning
    - > **No plateau effect (n = 0.297 at +21°C)**
  - Same additive mix – different behaviour





Sample preparation

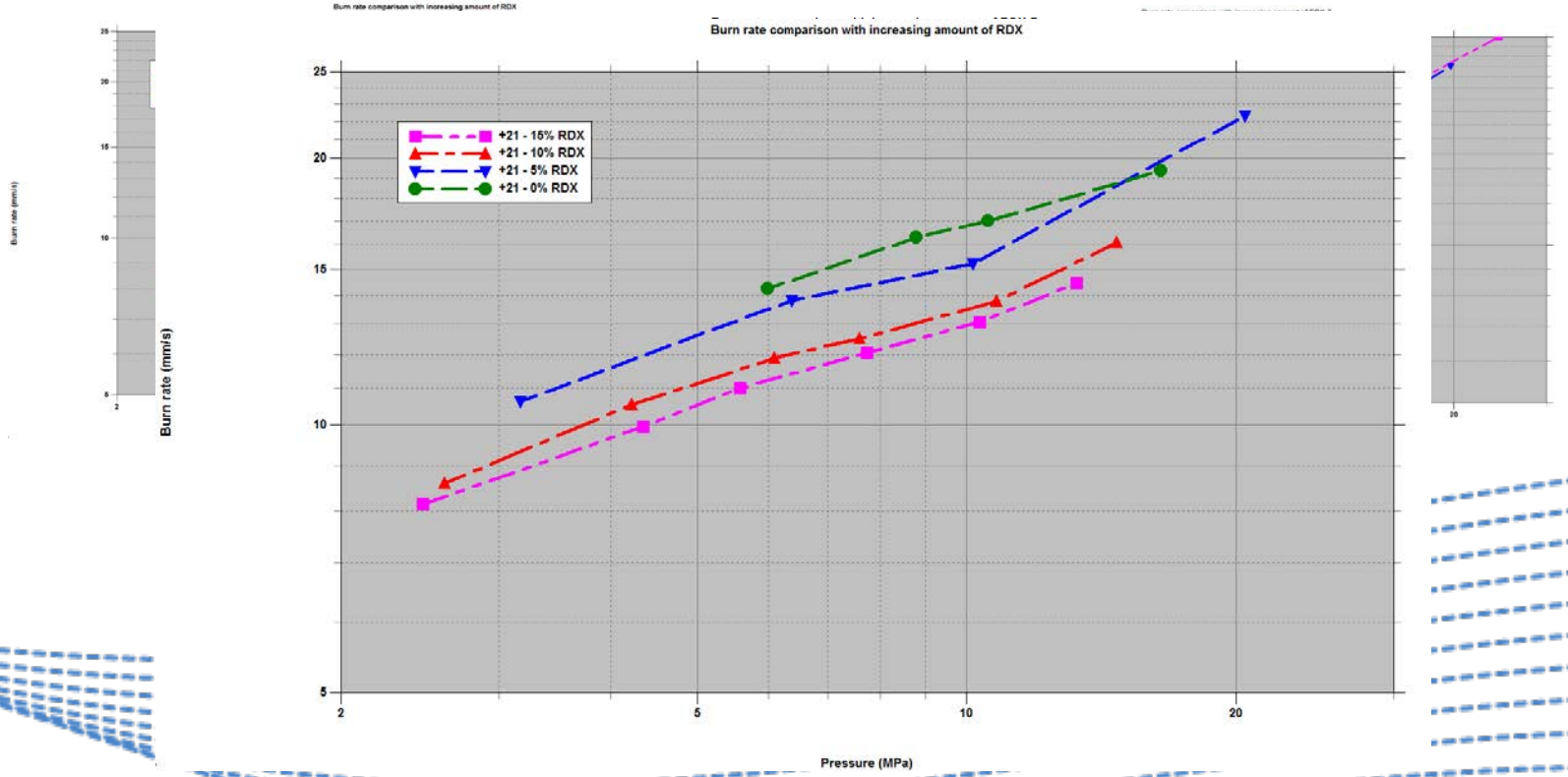
Pre-mixed propellant with additives

Second blending with high explosive addition

Propellant extruded into hollow cylinders and fired in mock-up motors

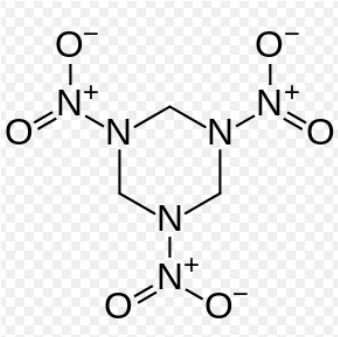
Results

Burn-rates at +21°C



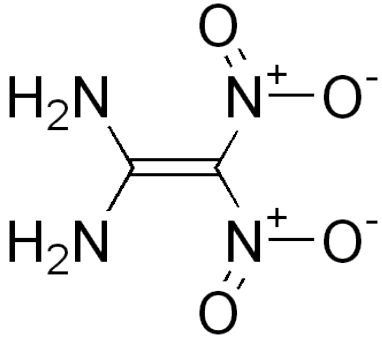
Results

Same



$C_3H_6N_6O_6$

MW = 222,12 g/mol



$C_2H_4N_4O_4$

MW = 148,08 g/mol

Conclusions

- Reduce gap to composite propellants.
- Reduce energetic plasticizers
- Complement burn rate modifiers

Further work

- Analyze non-ballistic effect on propellant
  - Glass transition
  - Mechanical properties
  - IM-signature

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Thank you for listening!

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