ADVANTAGE OF LESS SENSITIVE LTC GUN PROPELLANT

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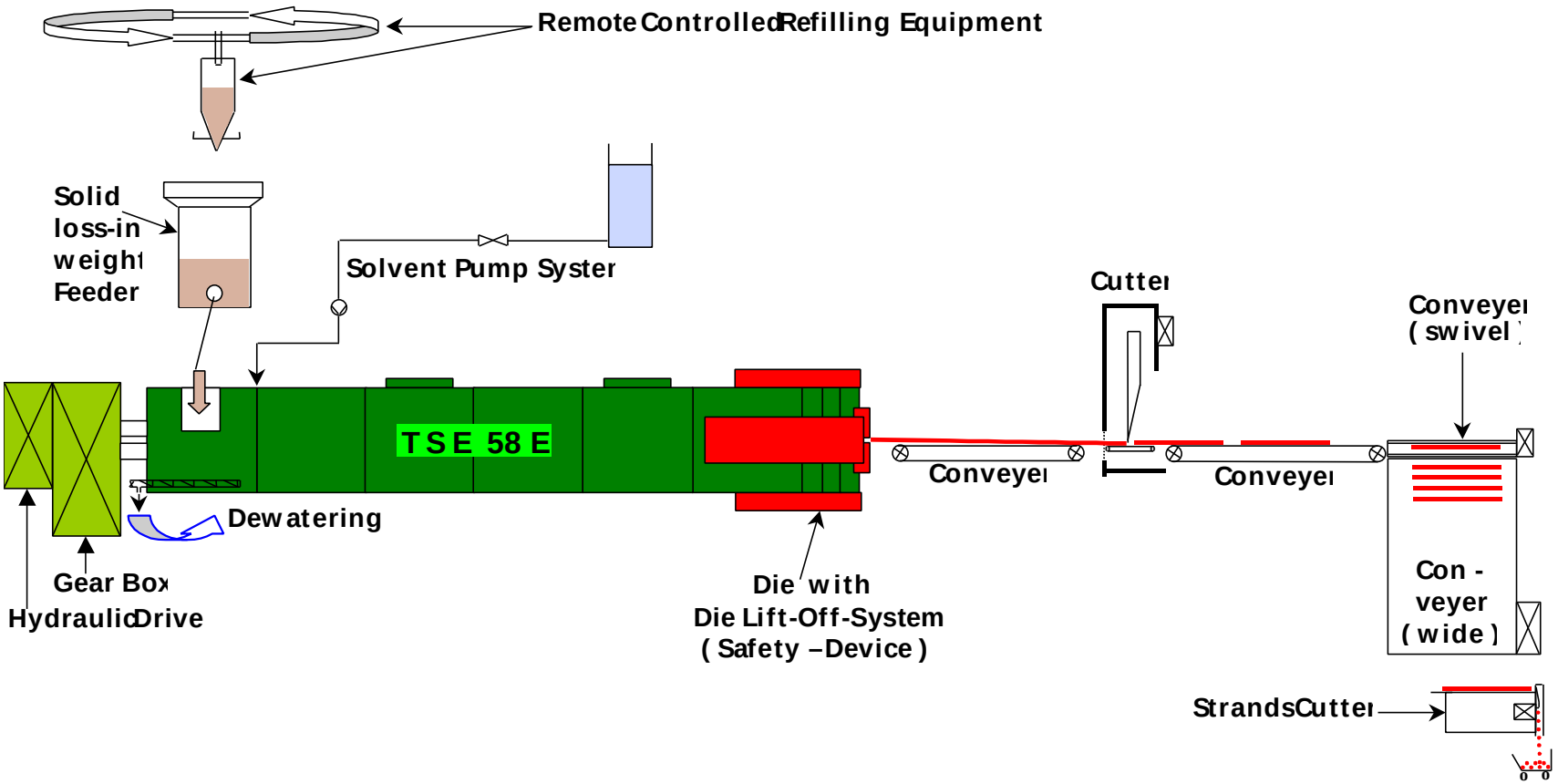
DIEHL Munitionssysteme

Content

- Processing Technology
- LTC Propellants
  - Sensitivity datas
  - ARC
  - DSC
  - Chemical Stability
  - Closed Bomb Tests
  - Gun Test Firing
- Results & Conclusion

Twin - Screw Extruder Process



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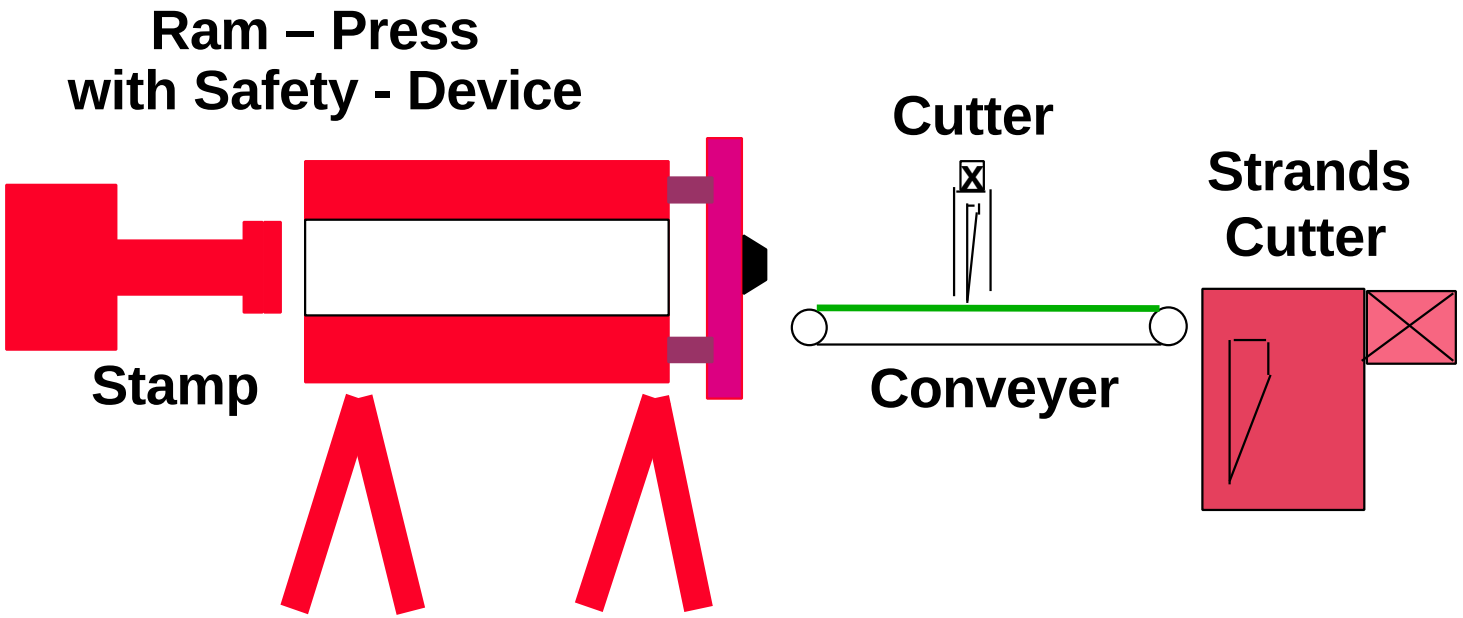
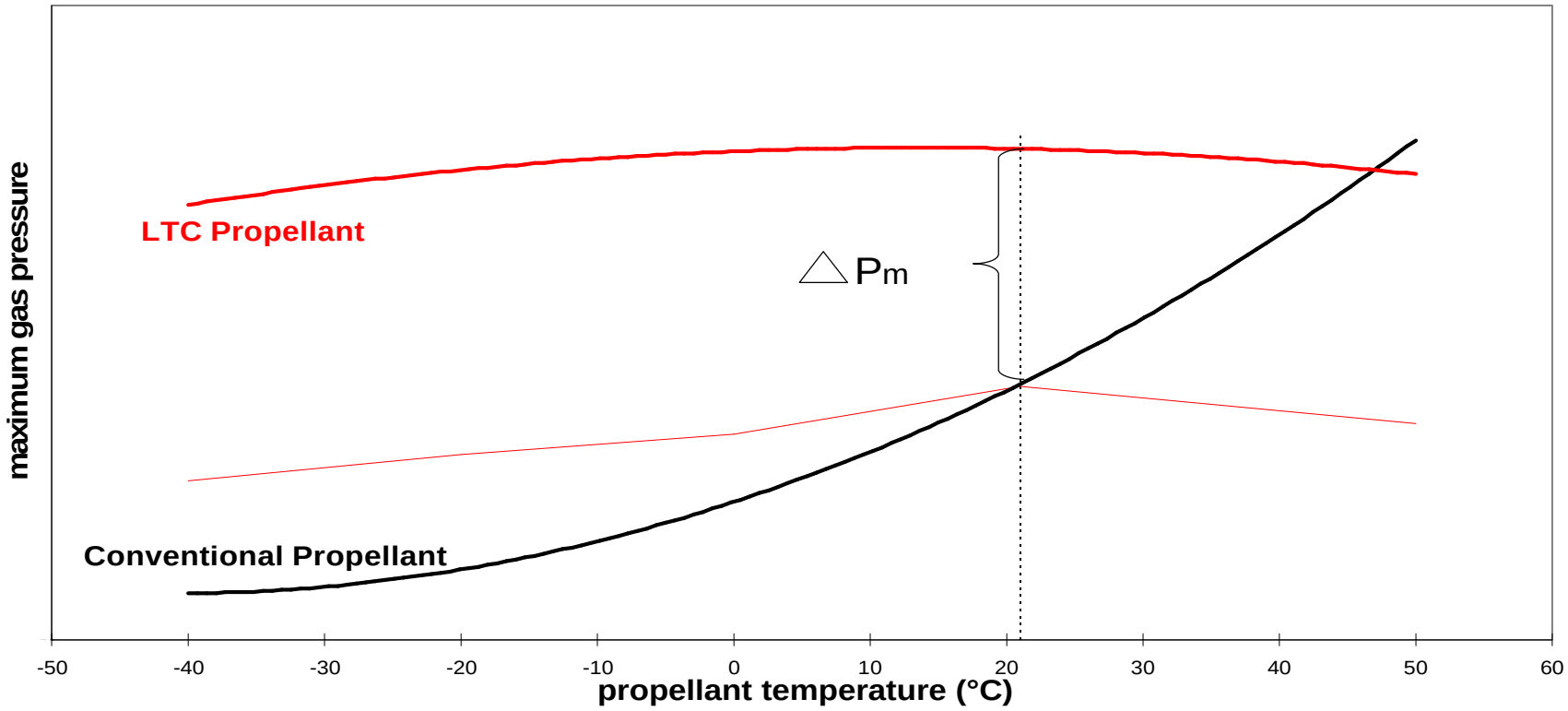
Batch - Processing



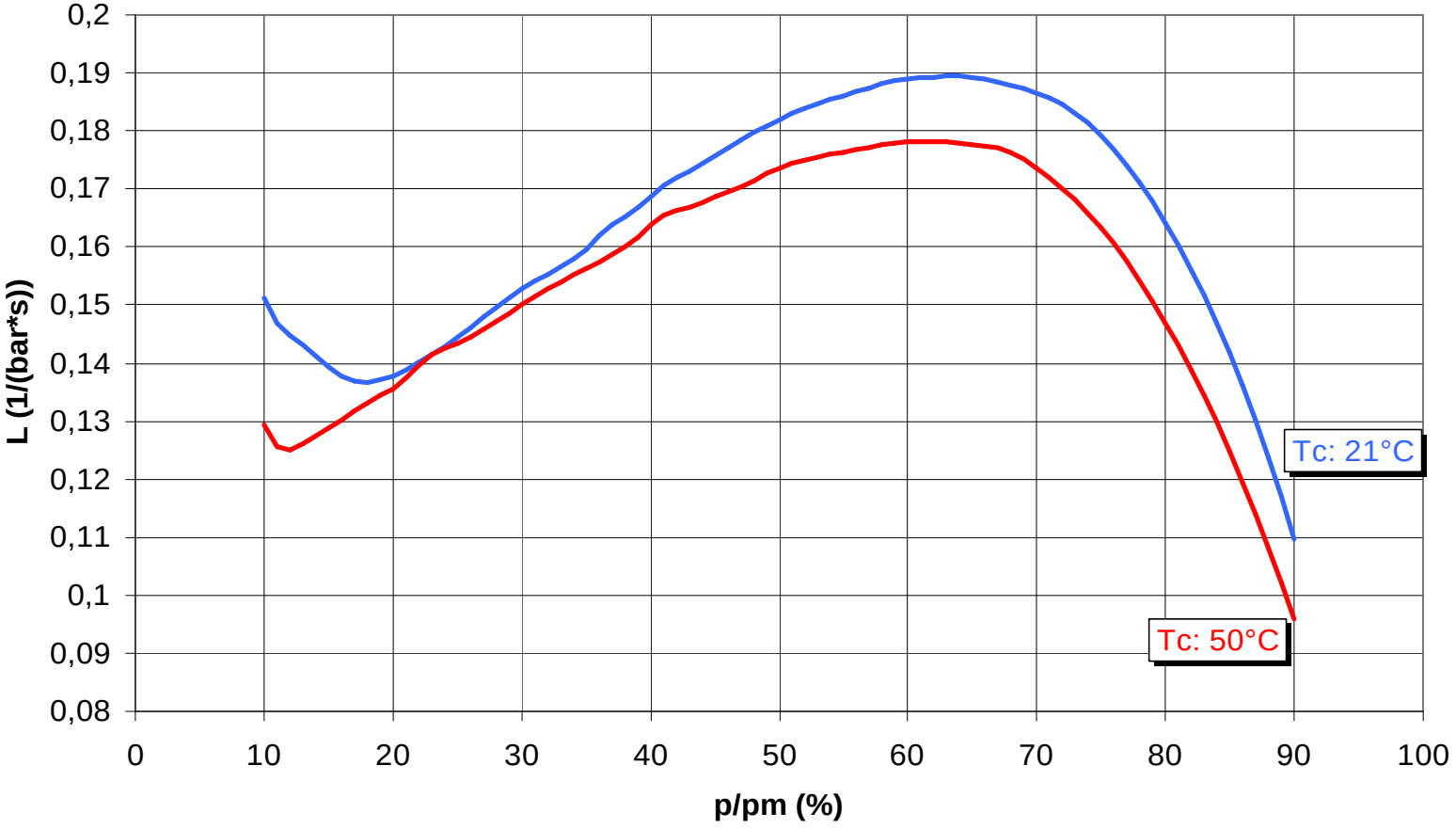
Temperature behavior of gun propellants

Max. gas pressure vs propellant temperature



Typical Behavior of LTC Propellants

Dynamic Vivacity at 21 °C and 50°C



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LTC Propellants

- **RDX**
- **binder**
- **new plasticizer (3 Comp.)**

- **energy density adaptable**
- **flame temperature significantly lower than that of conventional propellants**

Formulation	*Impetus (J/g)*	*Flame Temp (K)*	*Mol wt (g/mole)*
1	*1080*	*2540*	*19.4*
2	*1180*	*2910*	*20.8*
3	*1300*	*3390*	*21.6*

Safety

Safety data

Loss of weight after 18 days	< 1.10 %
Loss of weight after 30 days	< 1.65 %
Sensitivity to friction	160 N
Sensitivity to impact	4 J
Ignition temperature	> 230 °C
Fast cook off test	burning
Shaped charge impact test	burning

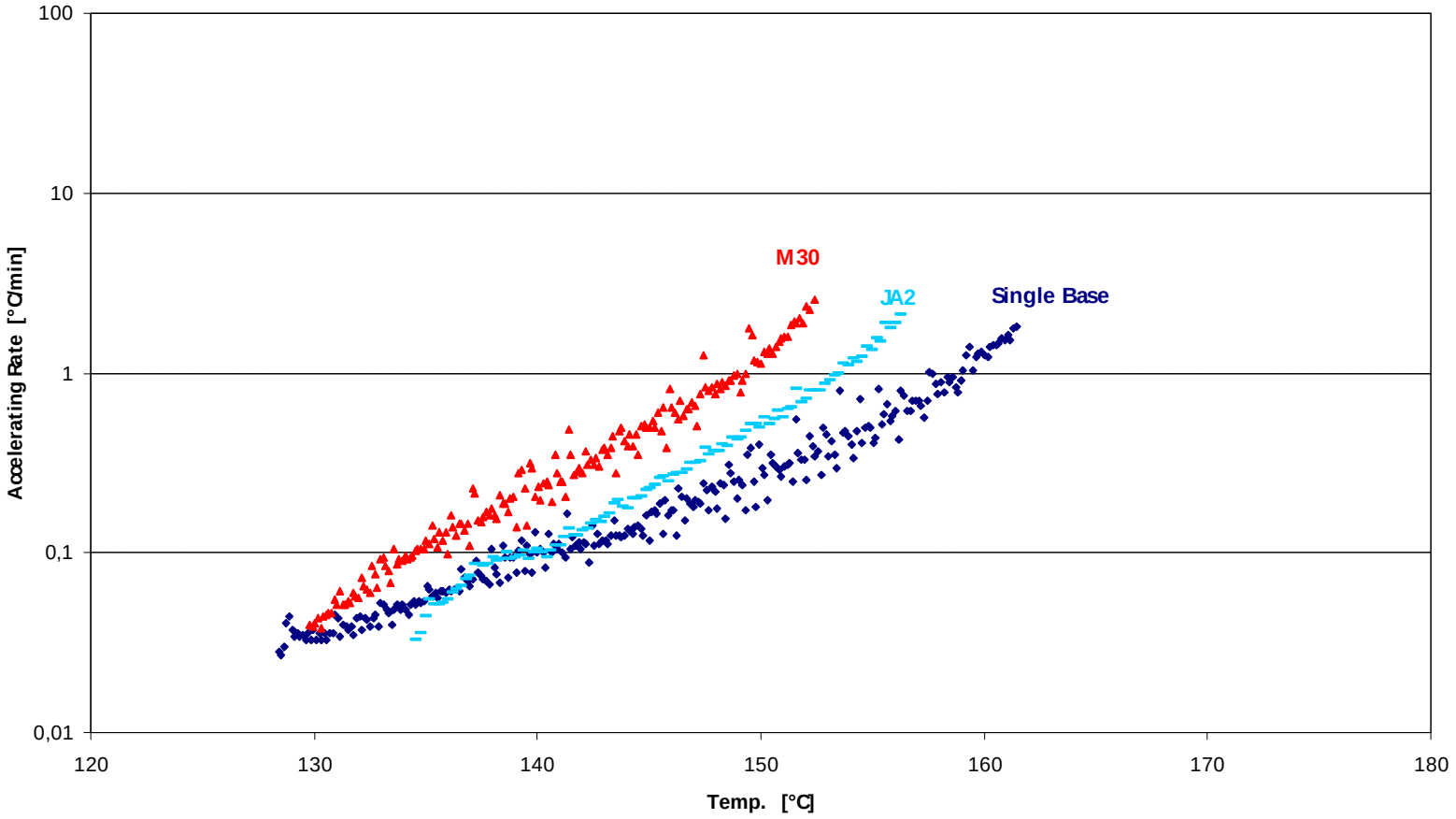
Viskosity of the New Plasticizer

Rotational Rheometer Results

+ 50 °C	20 mPa* s	
+ 20 °C	137 mPa* s	Newton Behavior
0 °C	1532 mPa* s	
- 6 °C	5595 mPa* s	
- 7 °C	6928 mPa* s	Structurally Viscose Behavior
- 8 °C	9059 mPa* s	
- 9 °C	11351 mPa* s	

ARC

Accelerating Rate Investigations of M30, JA2, Single Base Prop.



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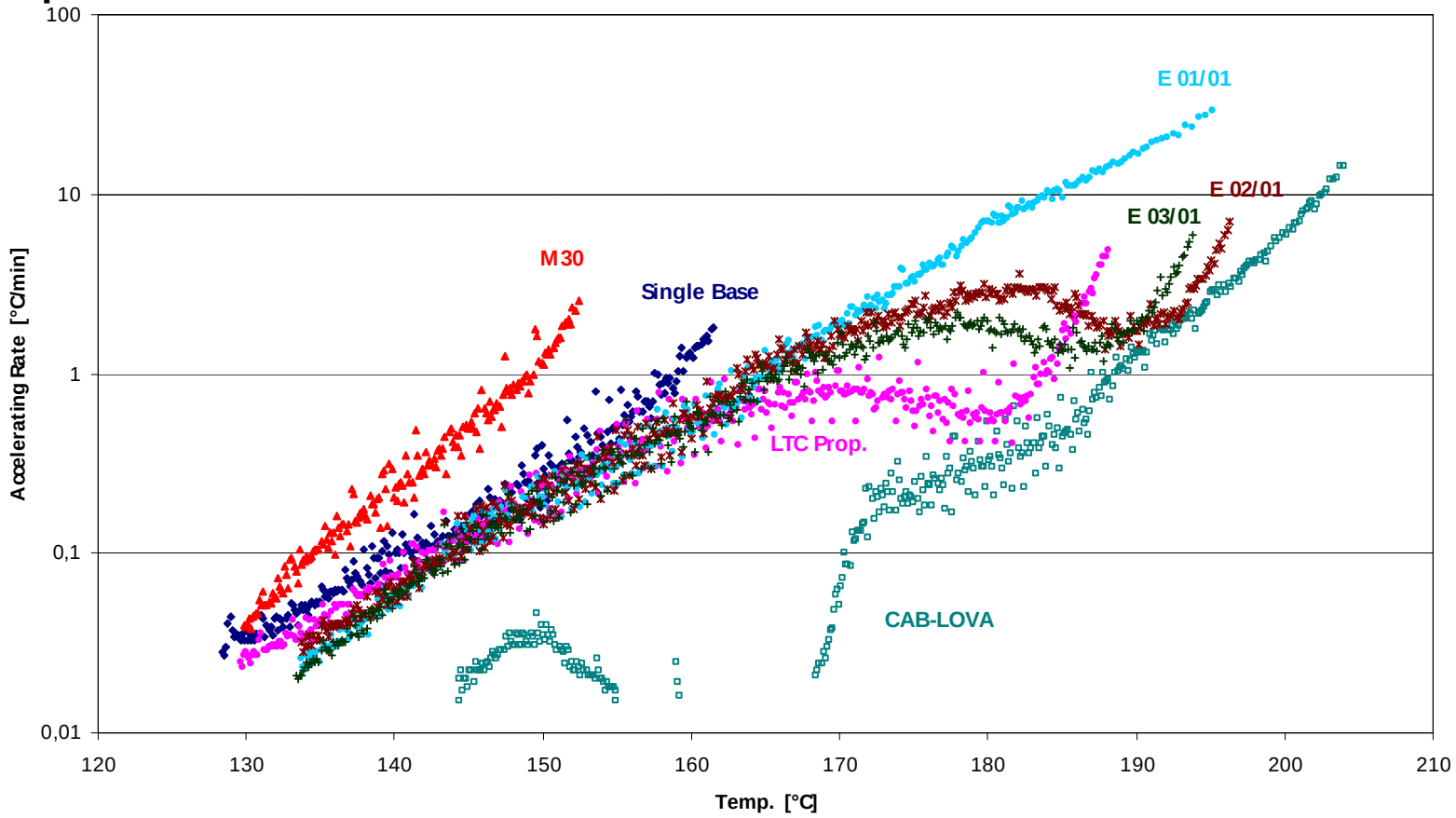
ARC

Accelerating Rate Investigations of LTC Propellants compared with CAB-Lova, M30 and Single Base Prop.



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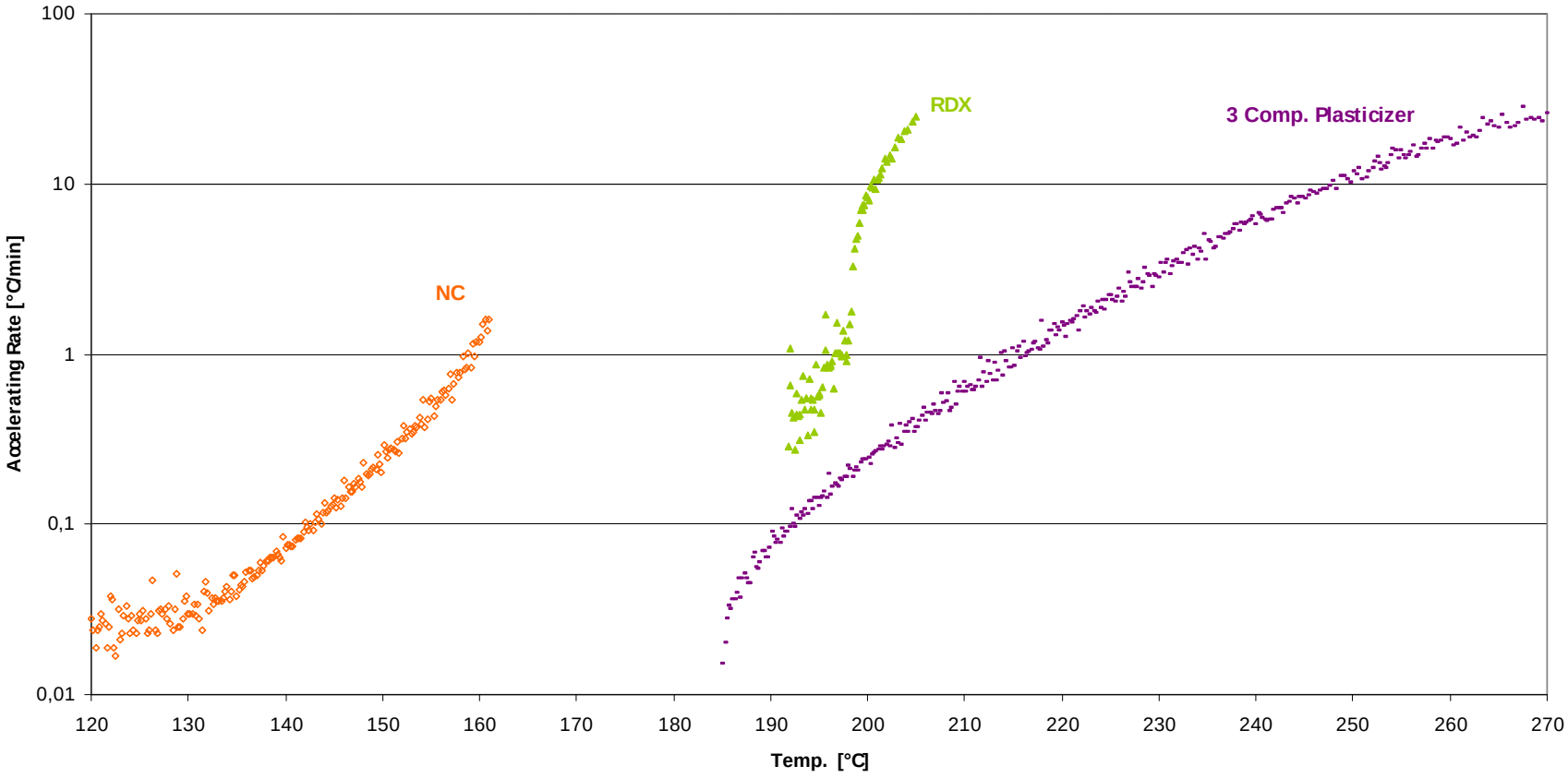
ARC

Accelerating Rate Investigations of NC, RDX and Plasticizer



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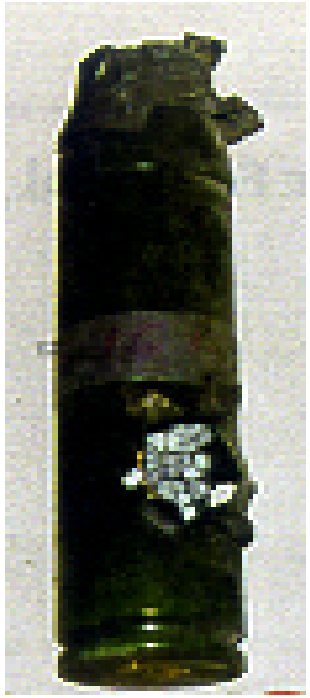
Shaped Charge Test (cal. 44mm)

Cartrige cal. 35mm

CAB -LOVA Propellant



LTC Propellant

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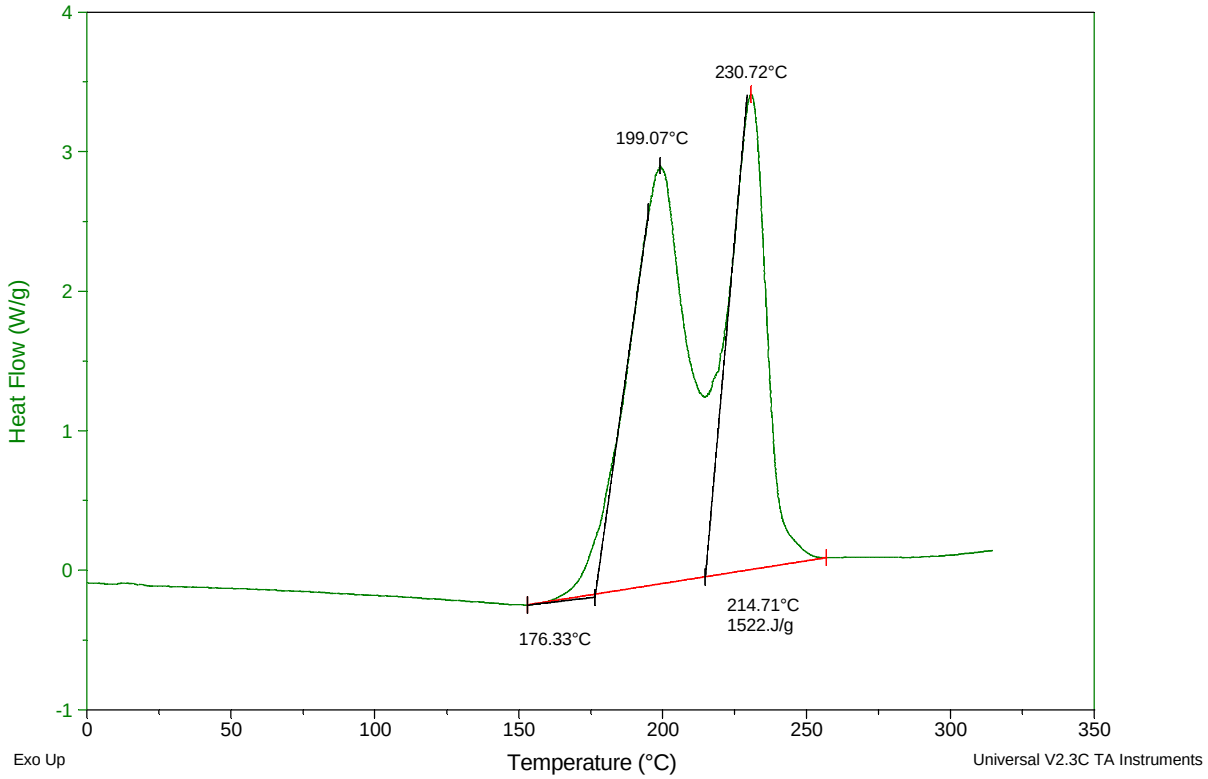
DSC Result

LTC Propellant for cal. 120mm Tank based on RDX / DNDA / Binder

Sample: LOS 250199/G
Size: 2.0670 mg
Method: HR5-500
Comment: gelochter Tiegel



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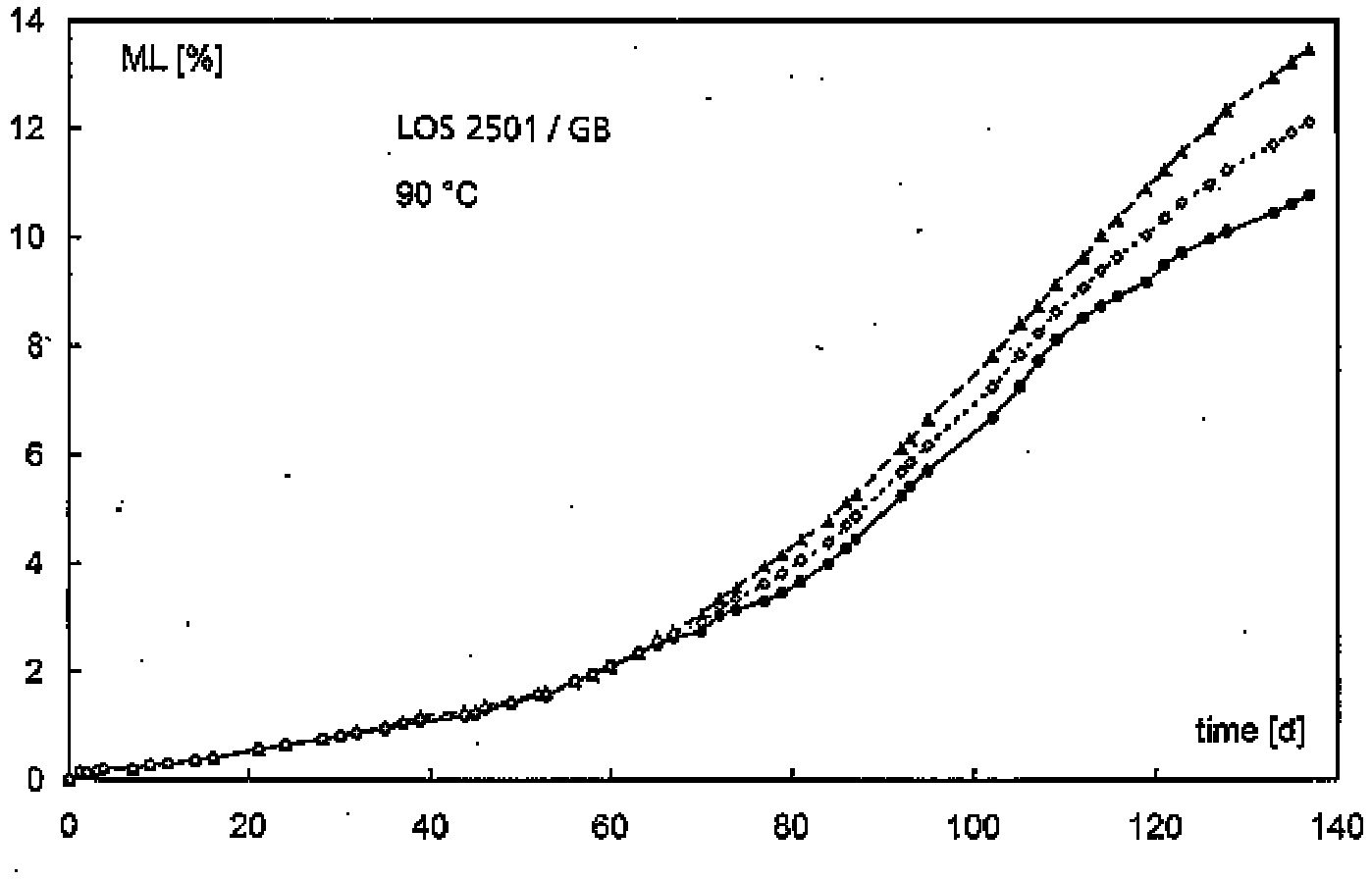
LTC GUN PROPELLANTS

Longterm Stability at 90°C / LTC - Propellant



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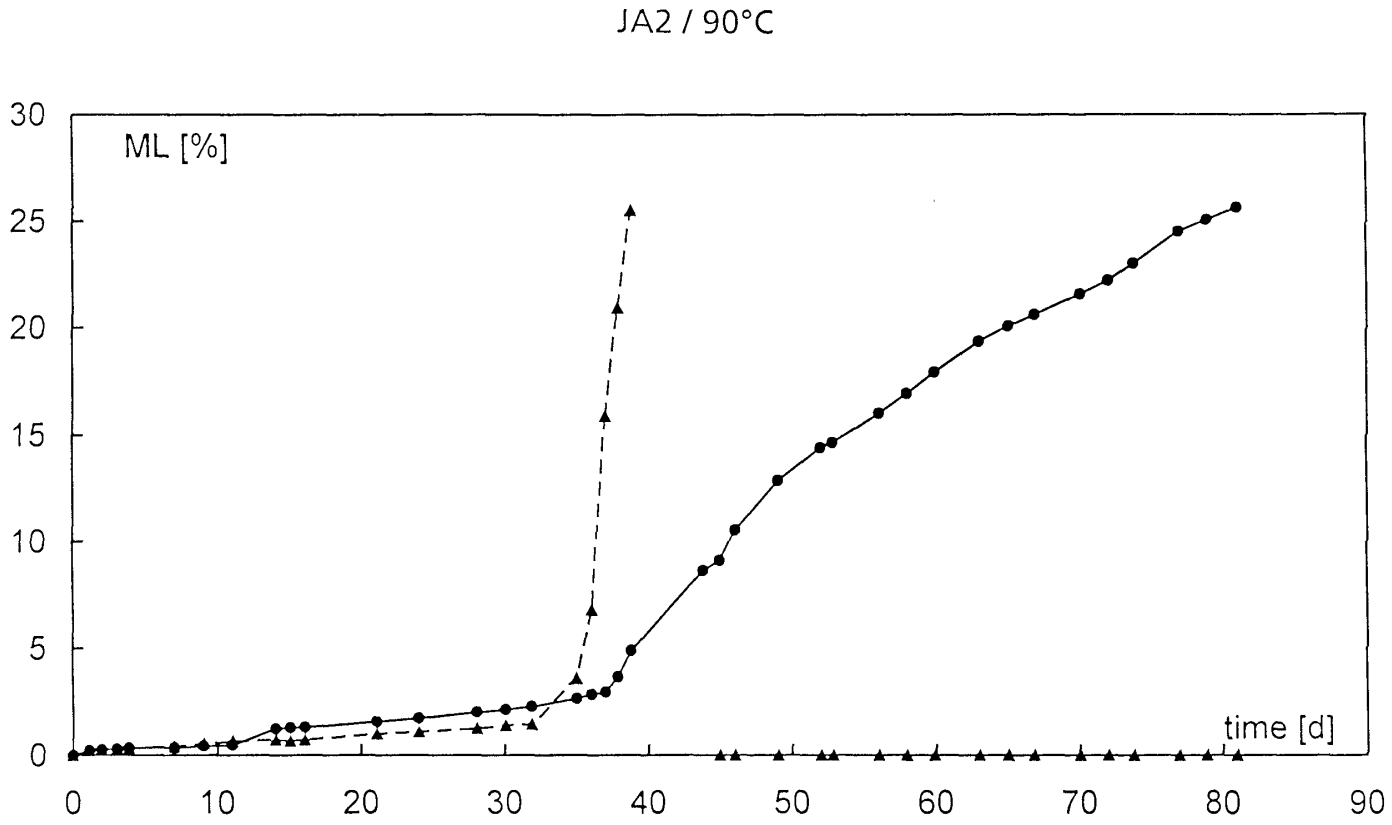
Longterm Stability of JA2 at 90 °C



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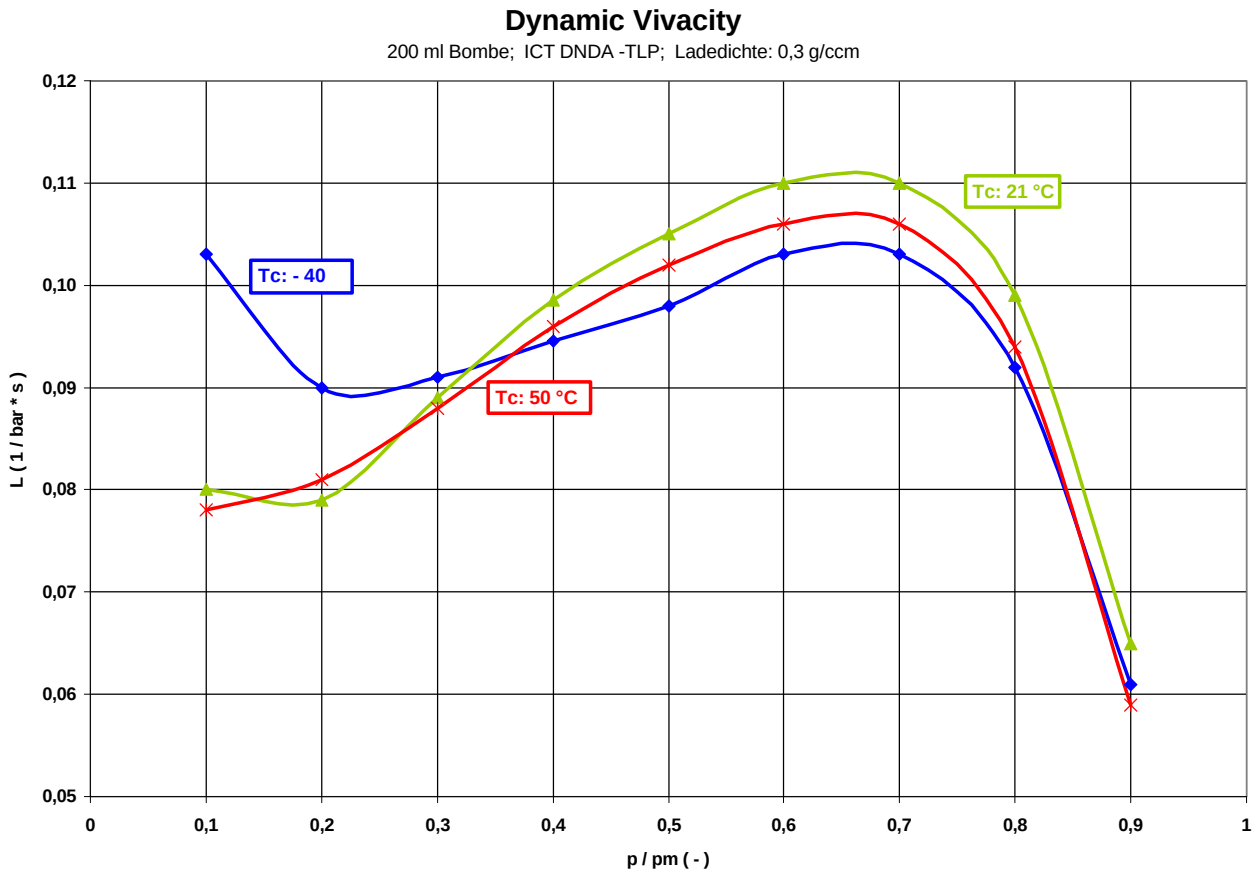
Long - Therm Stability in Days at 65 °C

	Storage Time in Days at 65 °C				
Wt - Loss	2%	3%	4%	5%	6%
Q5560	581	1032	1164	1428	1503
M30		531	670	810	1002
JA-2	524	1025	autocatalysis		
LTC-Propellants	601	1222	1408	1608	2270

Behavior of first LTC Propellant at -40 °C, +21 °C, +50°C in Closed Vessel



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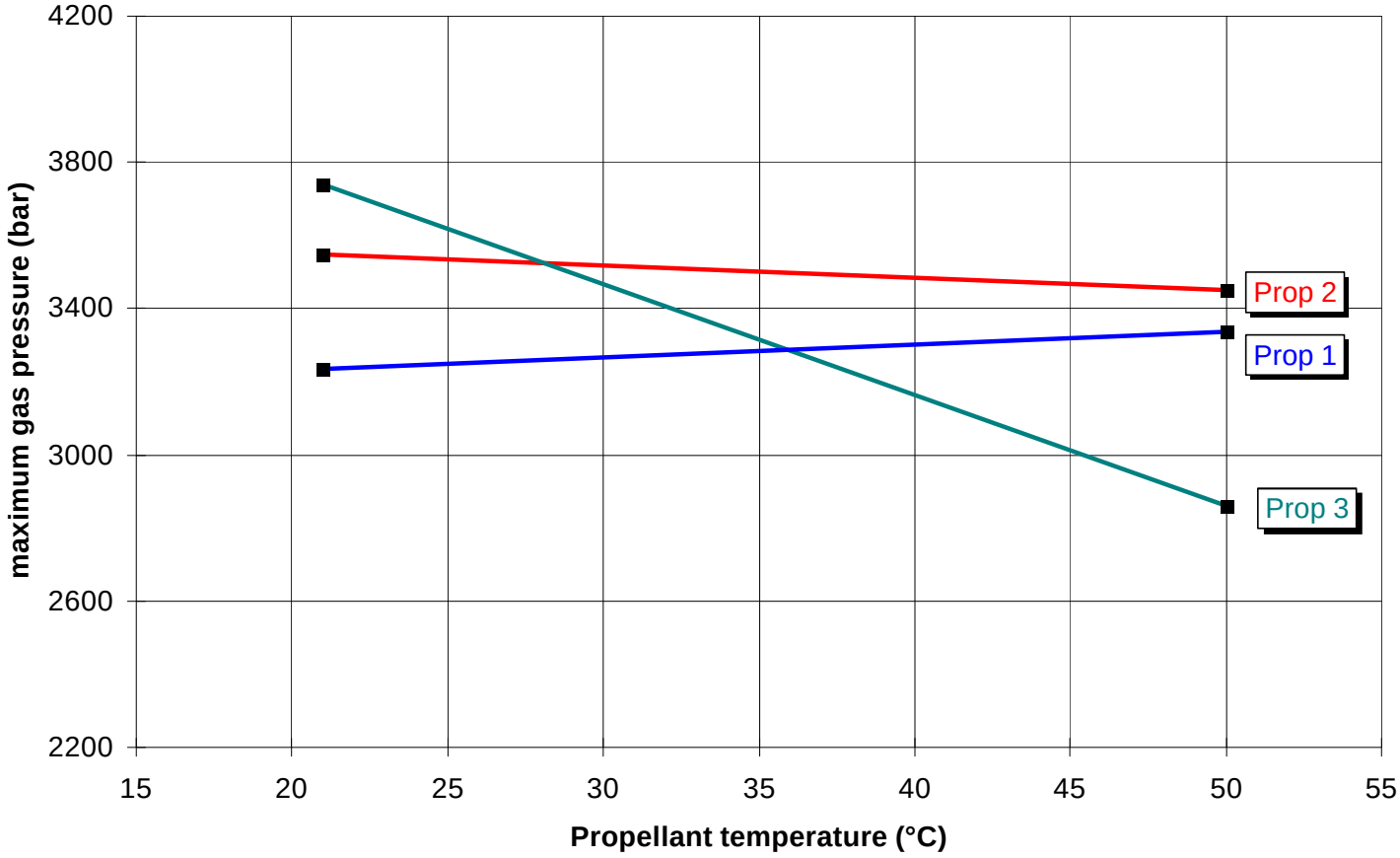
40mm Gun Firing Tests of 3 propellants

from -40 °C till +50 °C



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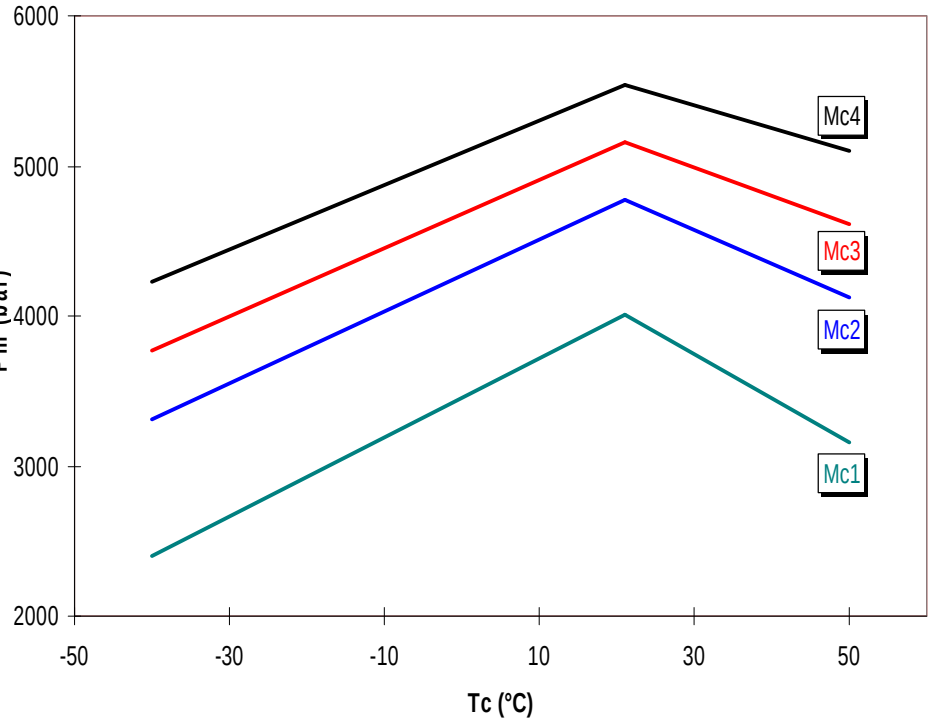
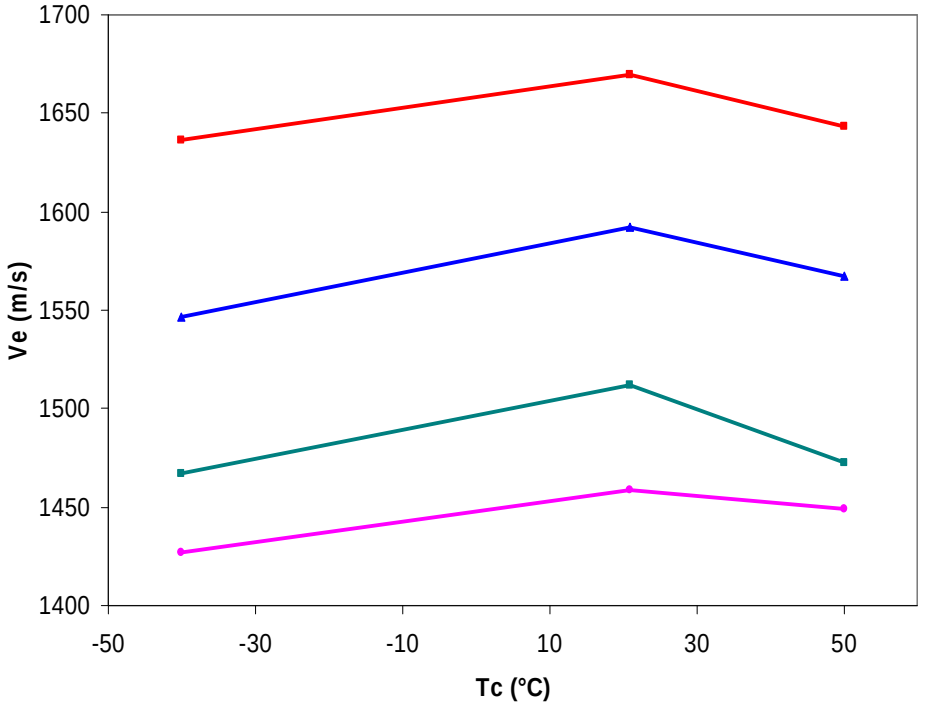
40 mm Gun Firing Tests

Temperature behavior unaffected by loading density and pressure level





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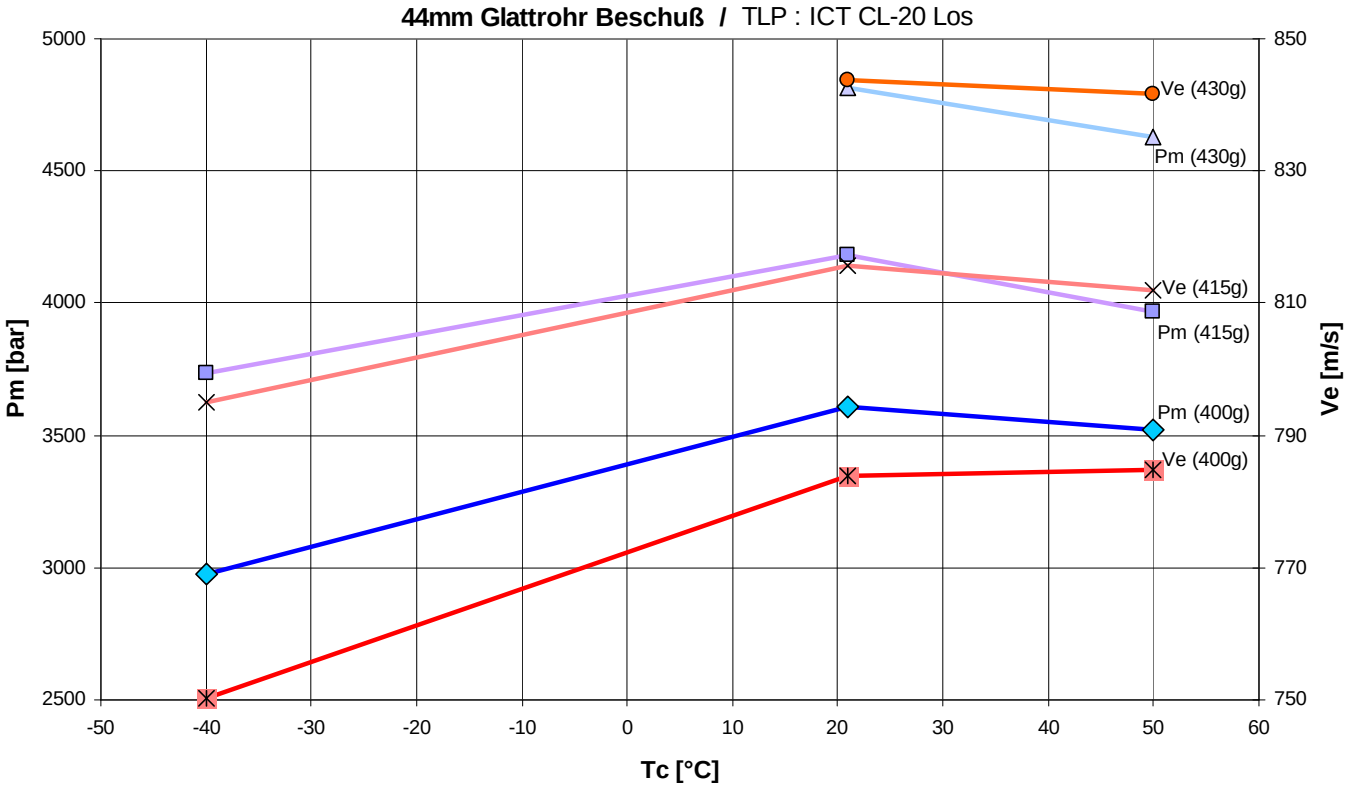
LTC Propellant based on CL-20

Test Firing in cal. 44mm smooth bore gun



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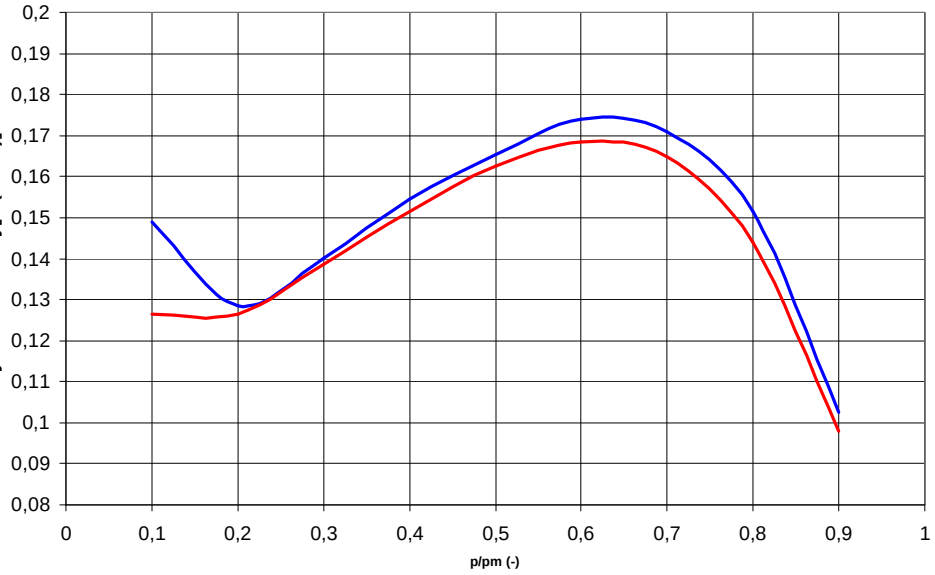
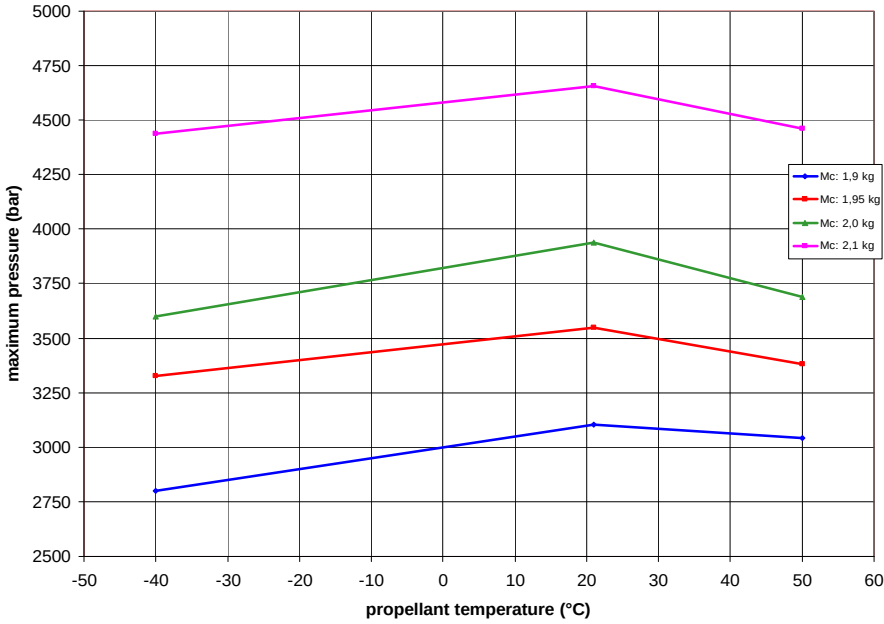
Application on Tank Ammunition

- Temperature behaviour in the closed vessel



- Temperature behaviour in the 75mm model gun



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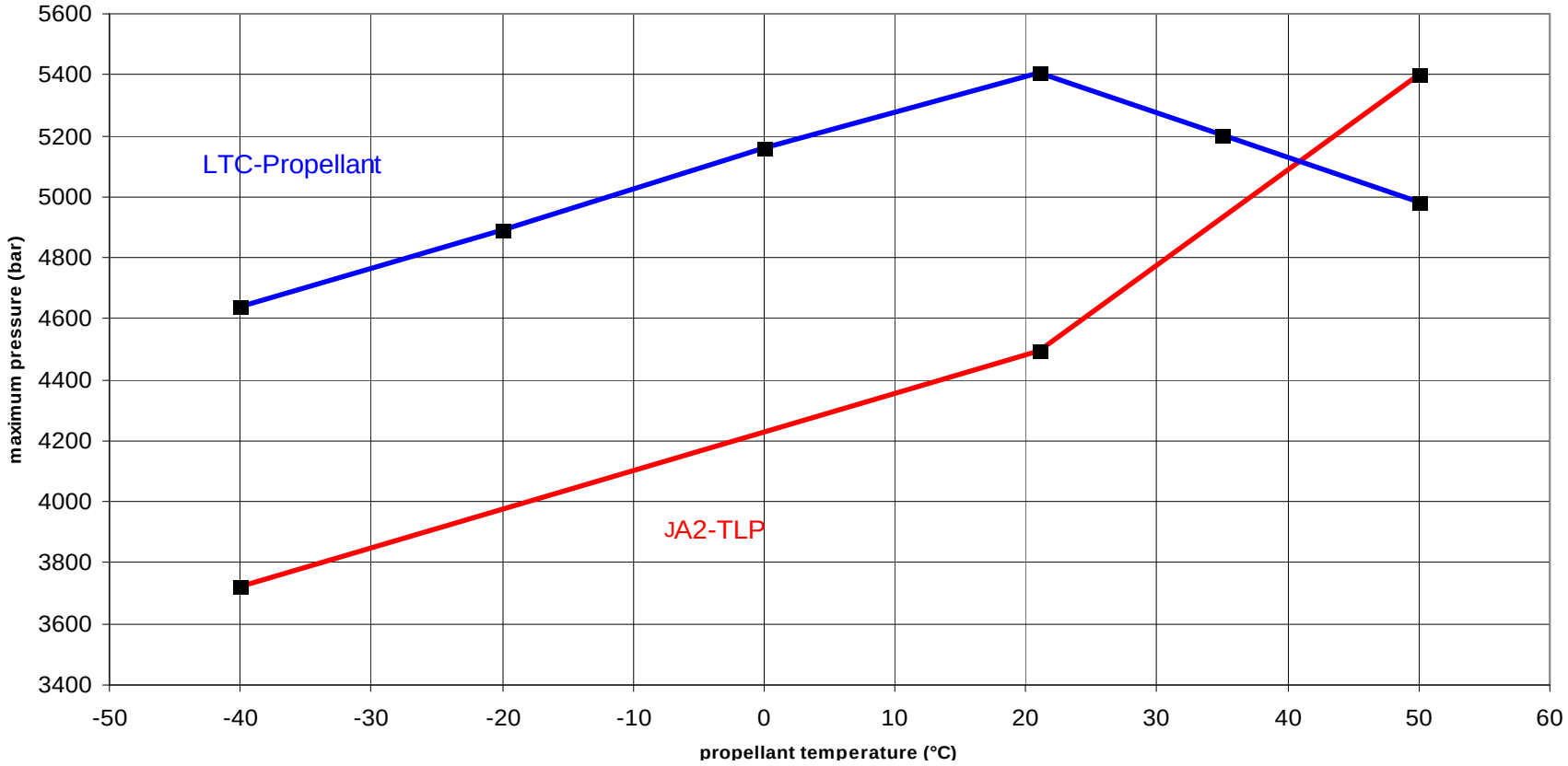
Test Firing in 75mm cal. Model Gun

Temperature behavior of LTC Propellant compared to JA2

Max. gaspressure vs propellant temperature



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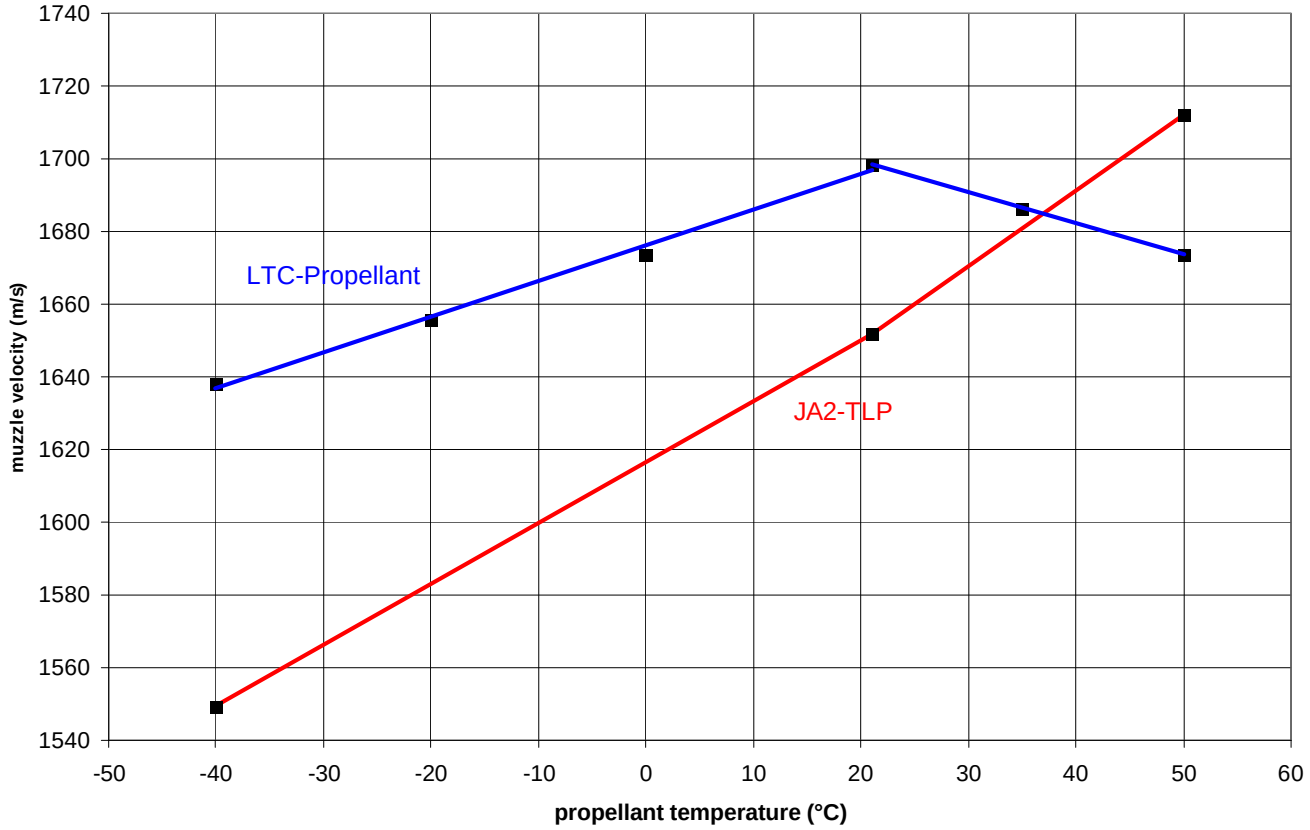
Test Firing in 75mm cal. Model Gun

Temperature behavior of LTC Propellant Compared to JA2

Muzzle velocity vs propellant temperature



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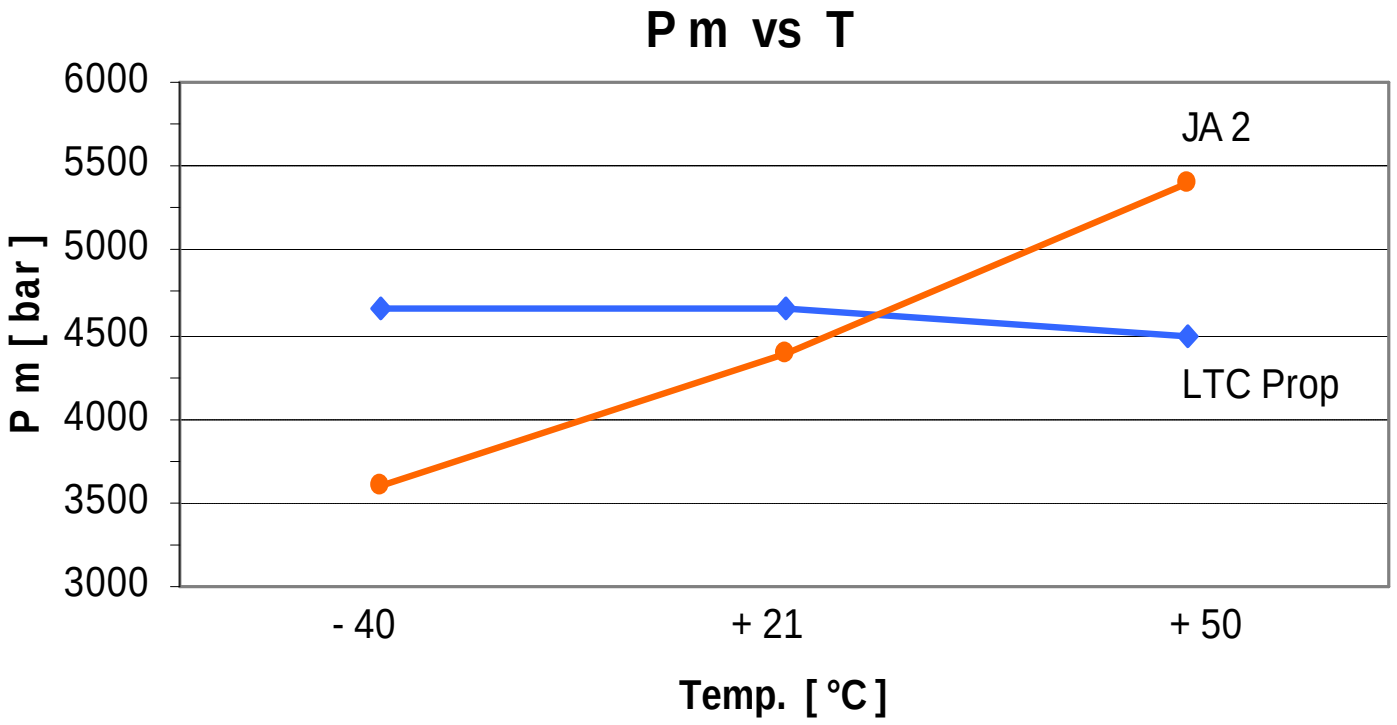
Test Firing in 75mm cal. Model Gun

Optimized Propellant for firing at 21°C

Gaspressure vs Temp.



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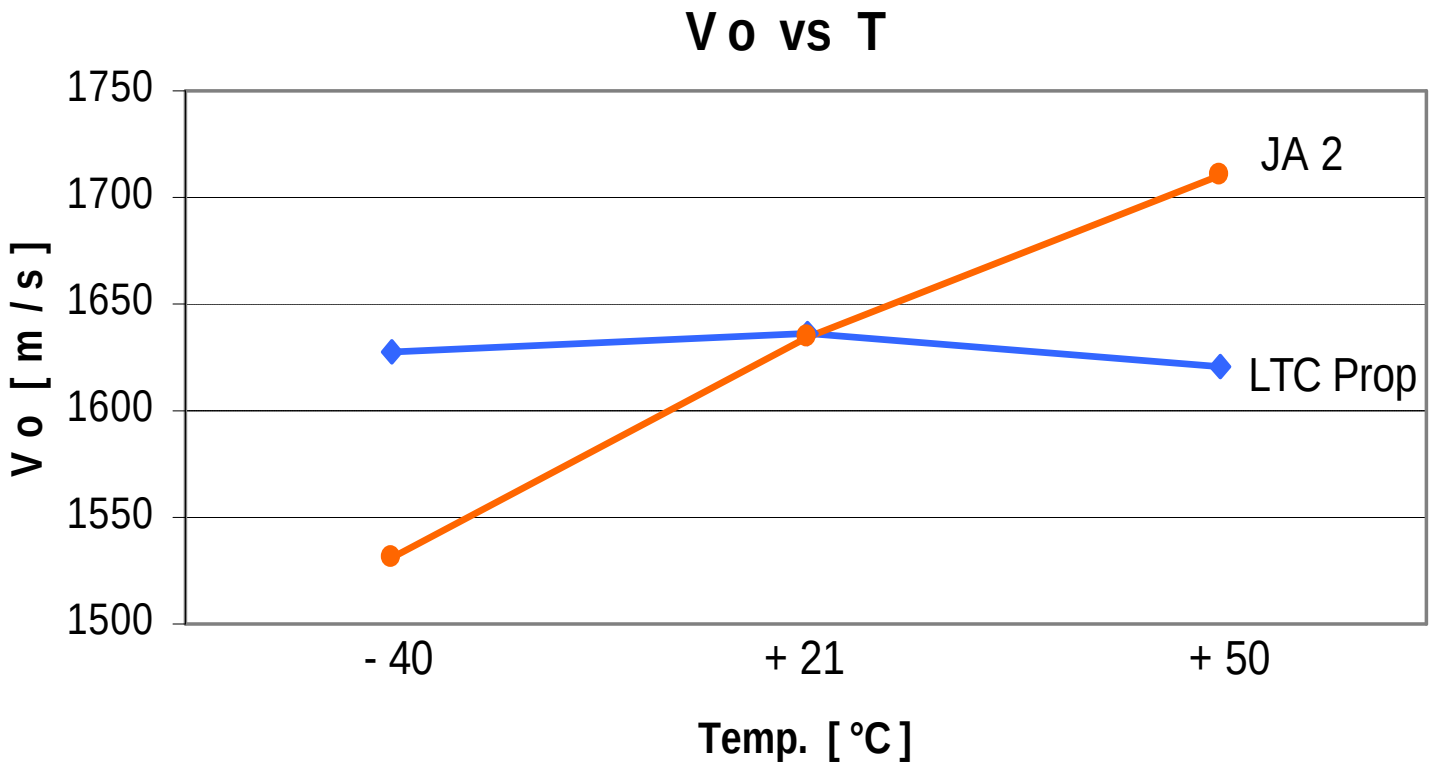
Test Firing in 75mm cal. Model Gun

Optimized Propellant for firing at 21°C

Muzzle velocity vs Temp.

Muzzle velocity of LTC Propellant same at 21°C like JA2



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75mm Scale model gun derived from 120mm tank gun

- based on interior ballistic similary laws
- less cost (combustible paper case, less propellant mass)

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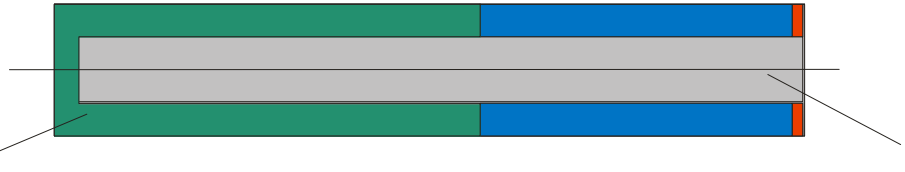
Diehl PELE Ammunition concept



High density material for tube
I.e. tungsten, steel

low density material for Inner core
I.e. plastic or aluminum

- PELE-Projectiles
  ® Highly effective against all targets

- New type of LTC propellant
  with low flame temperature (reduced erosion), high cook-off temperature

  - high shot precision within the temperature range
  - v_o independent of propellant temperature
  - High internal ballistic safety

  > No v_o - correction necessary

ABM - Ammunition Diehl

Features of Air Burst Munition

- Projectile with IHE = high fragment velocity

New type of LTC propellant
with low flame temperature (reduced erosion), high cook-off temperature

- high shot precision within the temperature range
- v_o independent of propellant temperature

> No v_o - correction necessary

Perfomance of LTC Propellant in 30mm Subcaliber

Parameter	EI - propellant	LTC propellant	≅ (increase)
Mass m = 235 g	v_o = 1385 m / s	v_o = 1455 m / s	70 m/s 5 %
Muzzle velocity v_o = 1385 m / s	m = 235 g	m = 268 g	33 g 14 %

Results & Conclusion

- LTC Propellants for a wide Caliber - Range
- PELE Ammunition, AIR BURST Ammunition (ABM)
- High Cook - Off Temperature >>200 °C
- Less Sensitive (Shaped Charge Test etc.)
- Excellent Chemical Stability
- Easily to Ignite by Pyrotech.