



RDECOM



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Twin Screw Processing of Black Powder w/ CMC binder & NC Binder

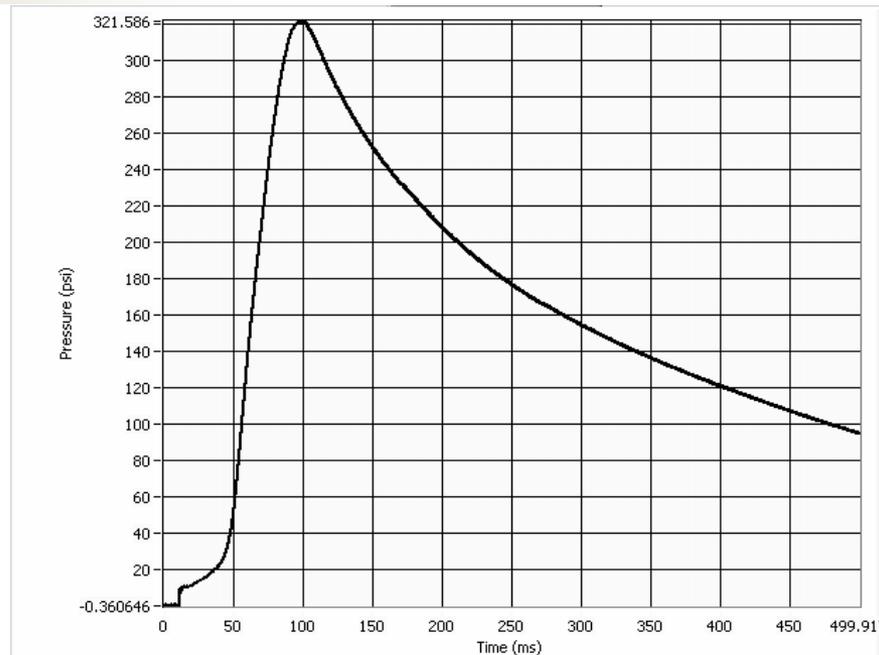
User Group 10-22-08

- In 2003 the US Army, in conjunction with GOEX, Inc. and TCI, started looking into manufacturing Black Powder Alternative (BPA) in order to provide a safer, more reliable process utilizing a twin screw extruder.
- This effort was first initiated by U.S. Army Program Executive Officer for Ammunition (PEO Ammo) which funded a foreign comparison test (FCT) to access BP standards. TSE BP was selected to be tested along with foreign sources.
 - January 2004: showed processability of a BP-type material through a TSE using a water soluble binder
 - » ~15 lb black powder substitute (BPS) produced
 - August 2006: provided a BPA with comparable performance characteristics as that of conventional BP using a water soluble binder
 - » ARDEC produced over 100 lb
 - November 2006: modified formulation to incorporate an energetic binder system (nitrocellulose)
 - 2007: New Universal TSE installed (installation, de-bug, validation)
 - January 2008: Produced a tunable Black Powder Formulation ~ 150 lb produced of both PBAs (CMC system, NC system)



Twin Screw Extrusion of Black Powder w/ CMC Binder



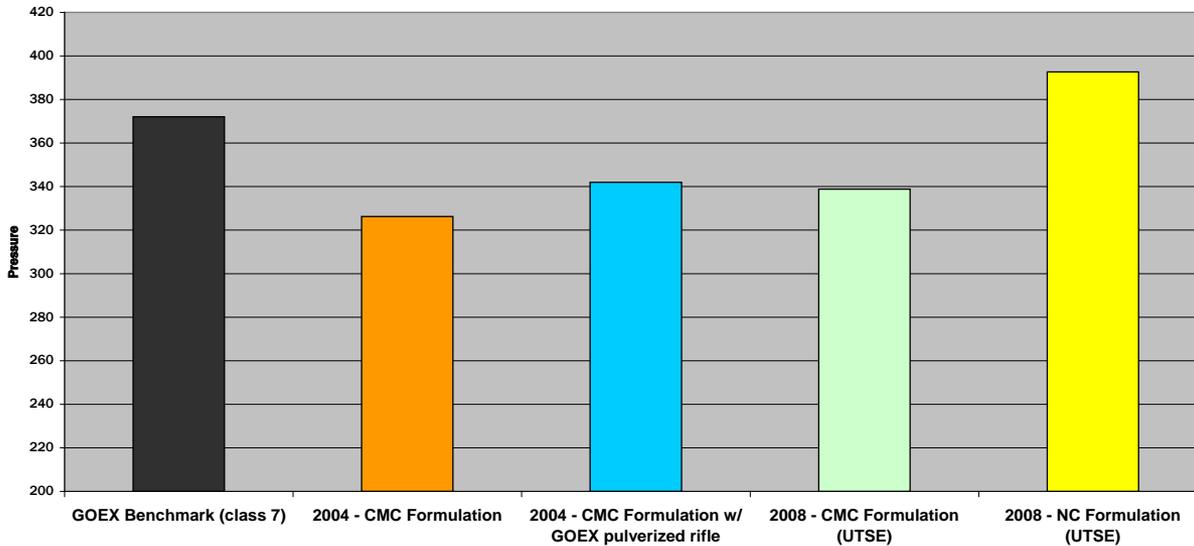


- Pressure vs. time data is collected
- Determines
 - Maximum pressure
 - Rise time (time from 10% to 90% of peak pressure)
 - Function time (time from t_0 to peak pressure)
 - Slope (slope of curve from 10% to 90% of peak pressure)

Testing – Closed Bomb

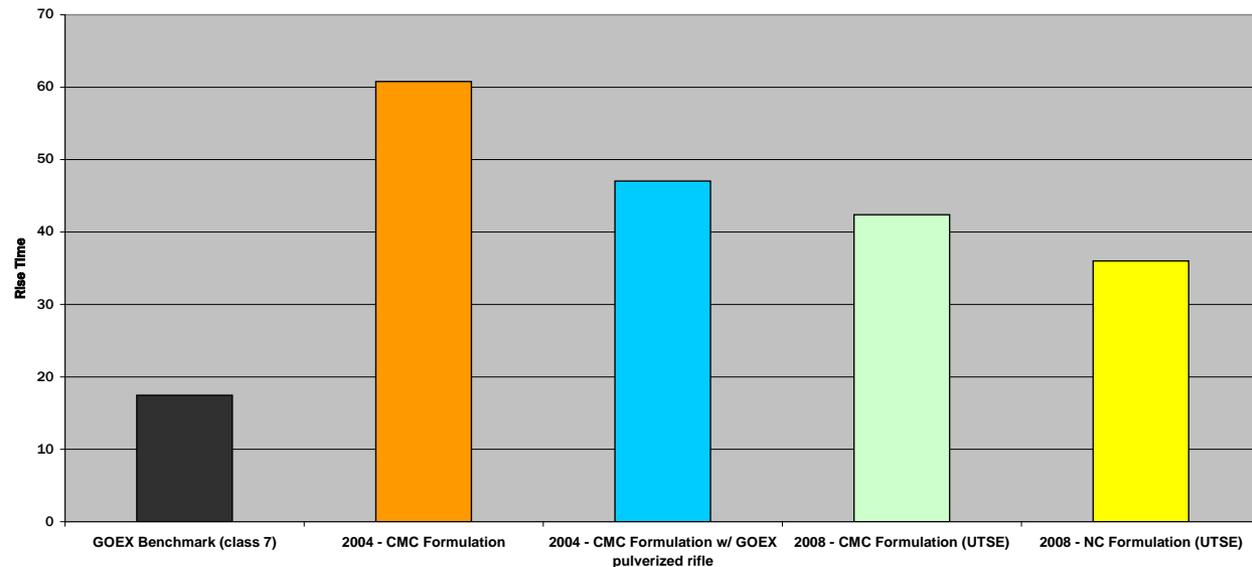


Max pressure (psi)



Maximum Pressure (psi)

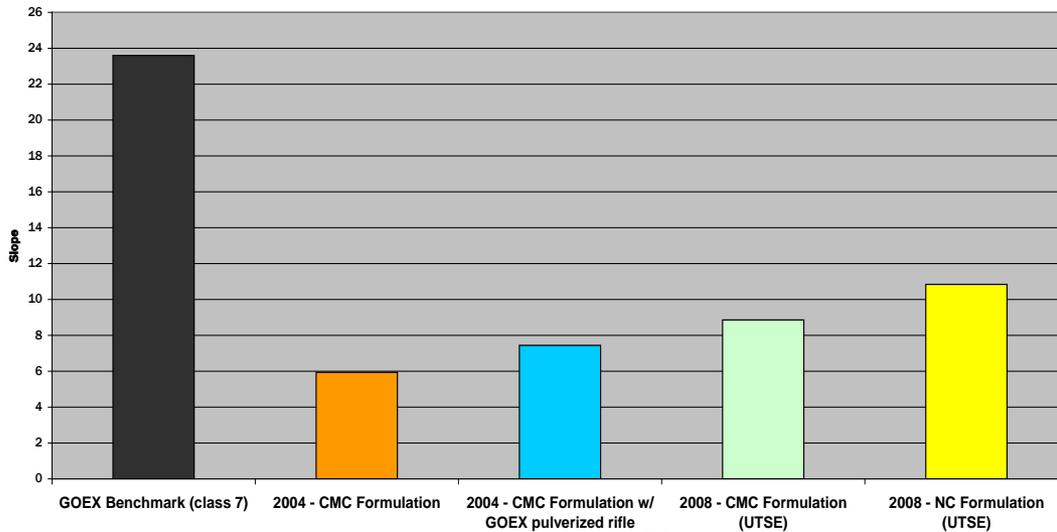
Rise Time (ms)



Testing – Closed Bomb



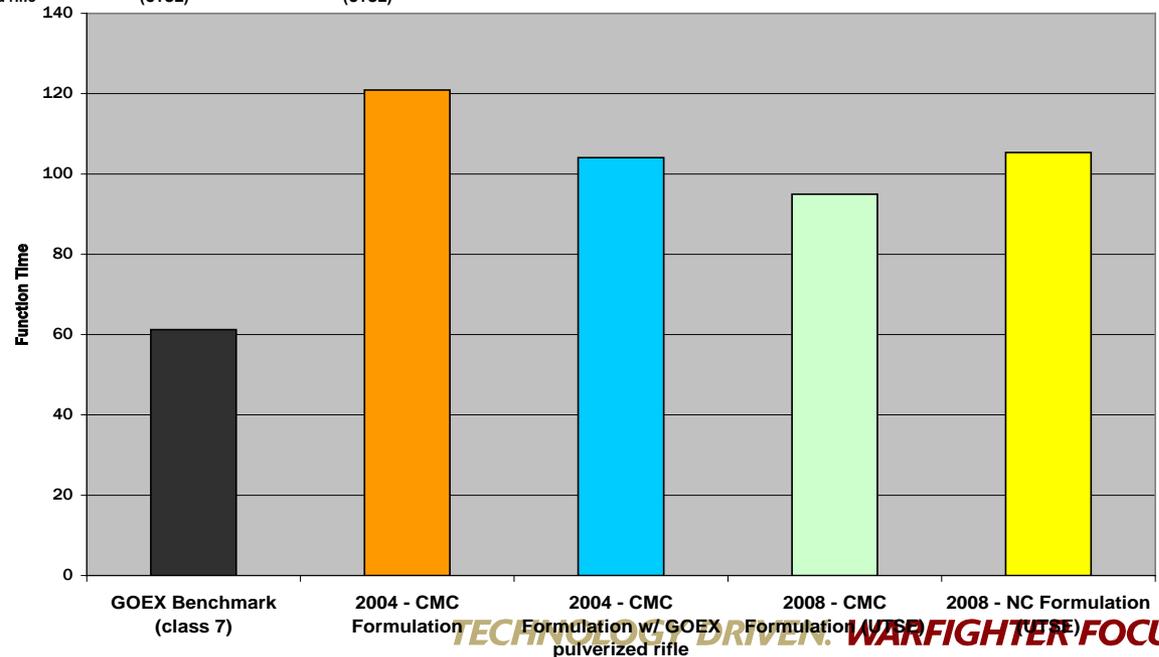
Slope (psi/ms)



Slope (psi/ms)

Function time (ms)

Function Time (ms)



For Interim Hazard Classification (IHC) a specific set of sensitivity testing was performed:

Test	GOEX Benchmark	TSE w/ CMC	TSE w/ NC
Impact	Standard	Better	Worse
ABL friction	Standard	Same	Same
Thermal stability	Standard	Pass	Pass
Electrostatic Discharge	Standard	Same	Same

End Item Testing

- Currently ongoing
- M74A1 Air Burst Simulator was chosen as end item for testing.
- Have some preliminary test results

Improved Processing

- Use counter-rotating machine to further consolidate the material

Post Processing Studies

- Quantify affect of post processing on material performance
 - Blocking, pressing, glazing, ect.

