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Evaluation of Nano Comp B

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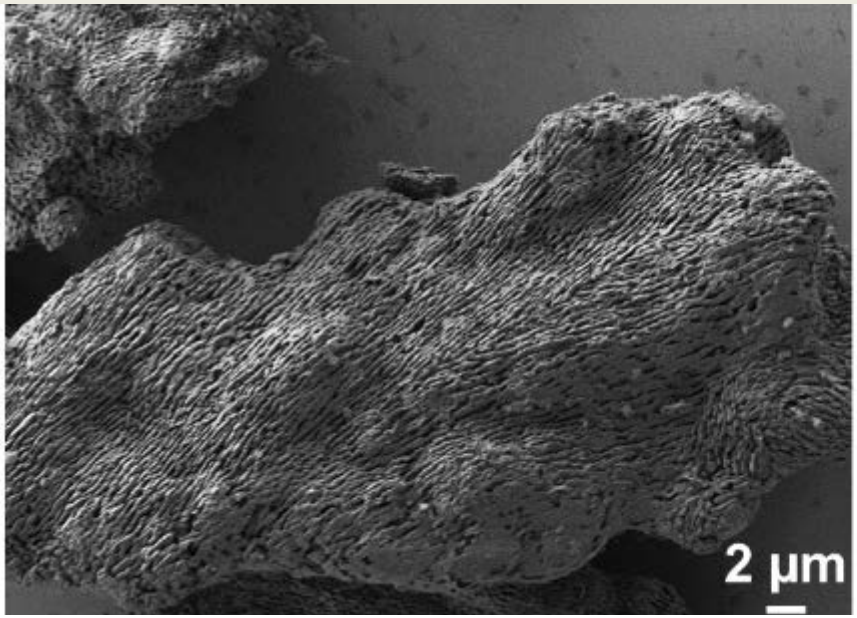
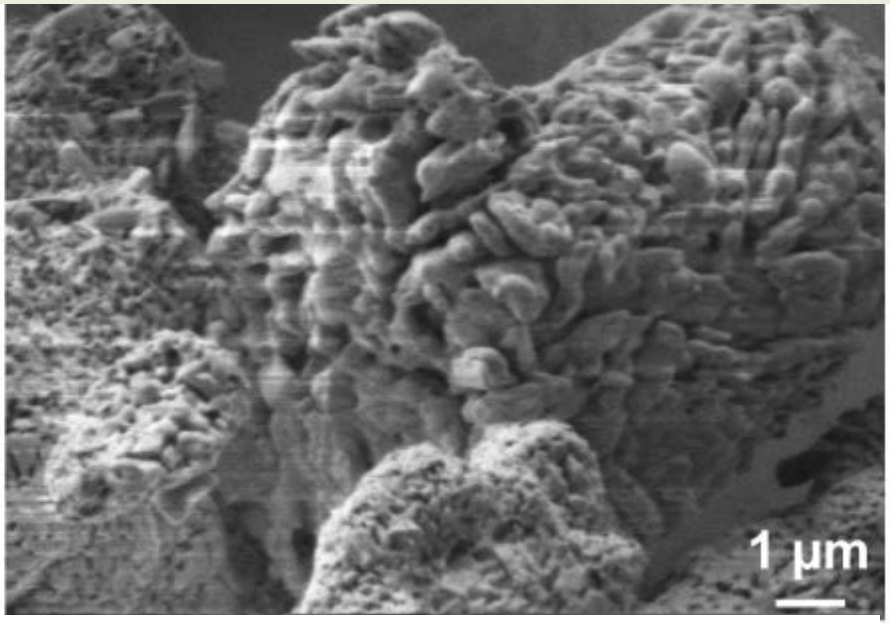
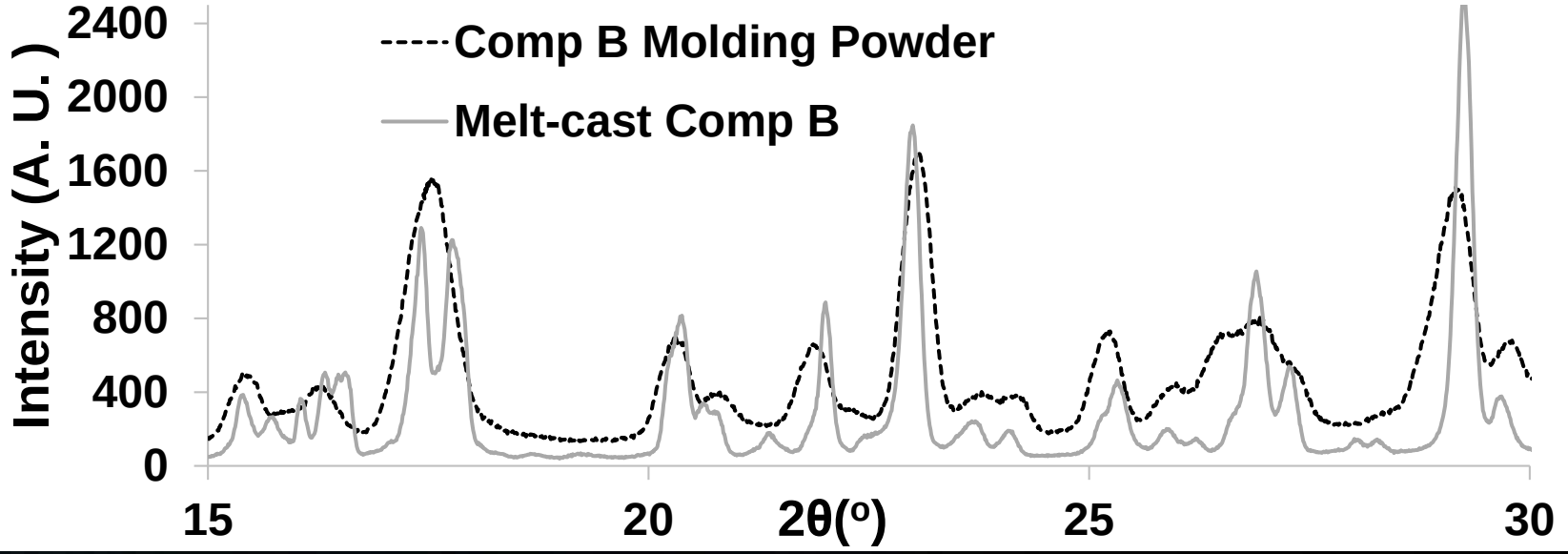
BACKGROUND

- To reduce the void size and therefore the sensitivity of Comp B, nanoscale high explosives were prepared by spray drying
- N-Comp B pellets were produced by compacting the N-Comp B powder.
- Detailed characterization shows that N-Comp B powder consists of nanoscale RDX and TNT
- The nanostructure of N-Comp B was characterized by focused ion beam-scanning electron microscopy (FIB-SEM)
- Shock sensitivity was evaluated using small scale gap test (SSGT)
- The characterization of the nanostructure shows that the majority of the voids inside the N-Comp B formulation are in the nanoscale range but have a large number density
- Reduction in shock sensitivity was observed in SSGT test and is attributed to the elimination of large voids, and yet the large number density of smaller voids seems to have limited the sensitivity decrease

SEM AND XRD ANALYSIS OF N-COMP B1 MOLDING POWDER

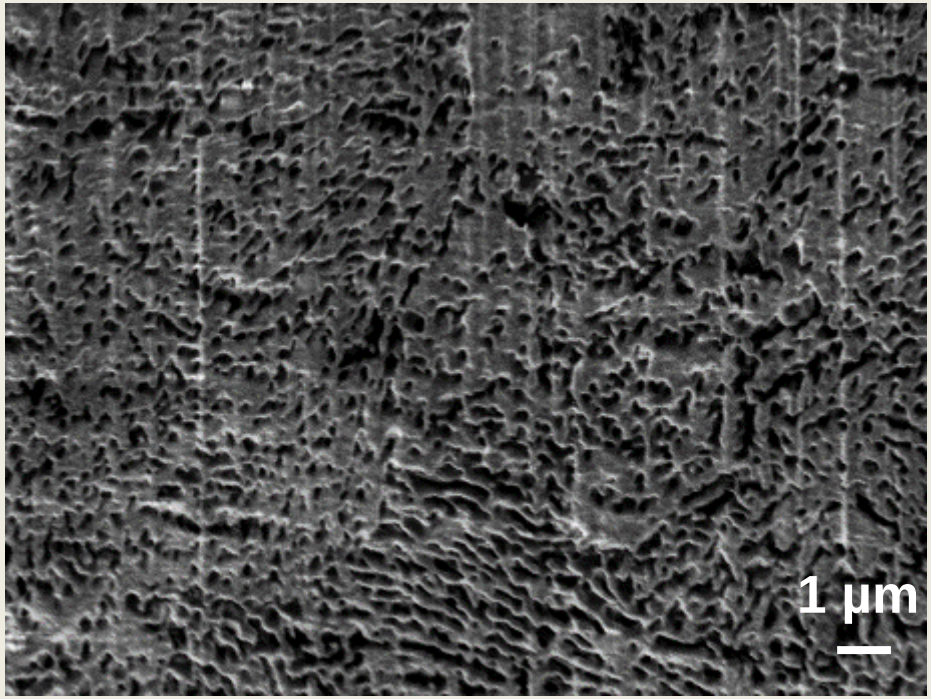




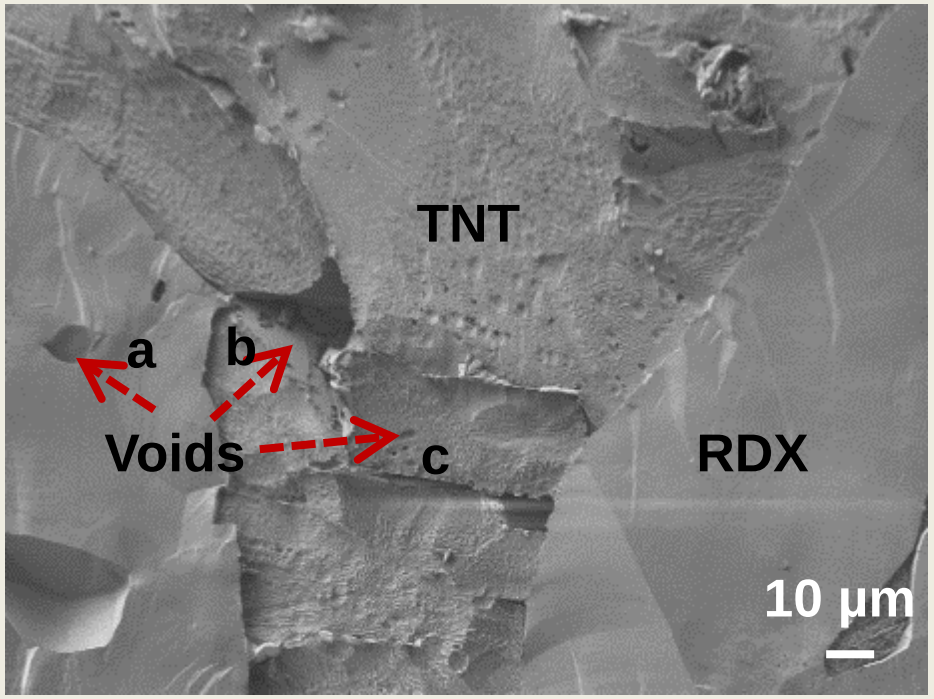


Structure of Compacted N-Comp B1 and Melt-cast Comp B

Compacted Pellets of N-Comp B1



Melt-cast Comp B



NANO COMP B VS LEGACY COMP B

Safety and SSGT Tests Results

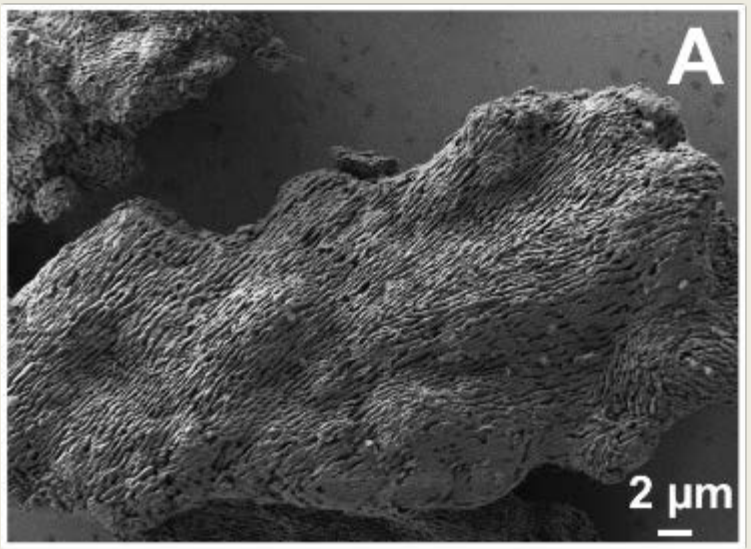
	Impact (cm)	BAM Friction (N)	ESD (J)	SSGT (%)
Comp B	33.9	192-168	-	100
N-Comp B1	51.6	252-240	0.051/0.040	116

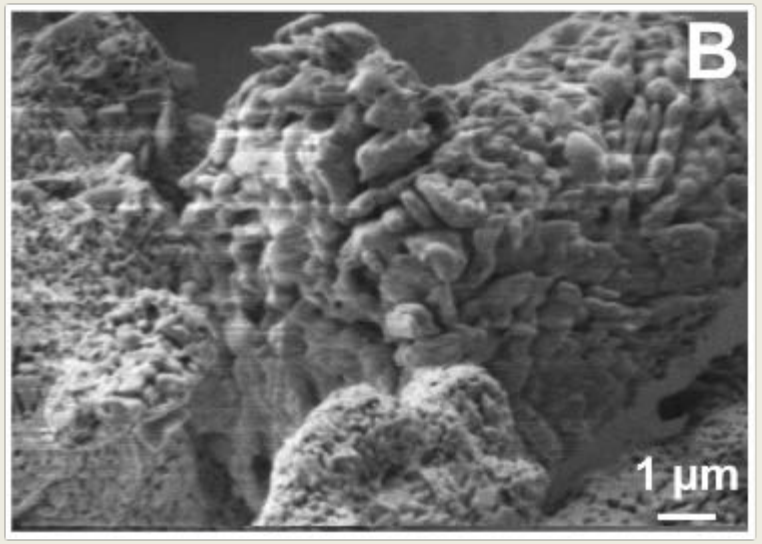
SUMMARY OF SAMPLES

Samples	Form	Description
Comp B	Powder/Flakes	Melt-cast Comp B; Powder was prepared by grounding the flakes
N-Comp B1	Powder/pellets	As spray dried and compacted Comp B with no polymer binder
N-Comp B2	Powder/pellets	As spray dried and compacted Comp B with a polymer binder

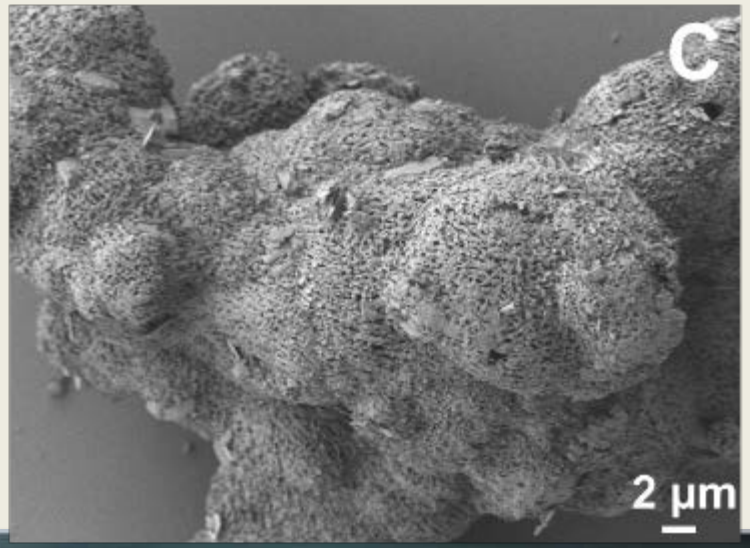
SEM Analysis of N-Comp B Molding Powder

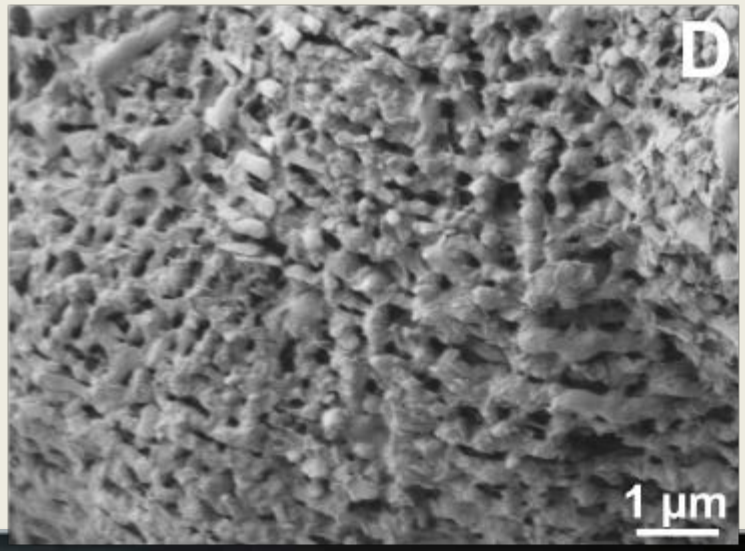
N-Comp B1



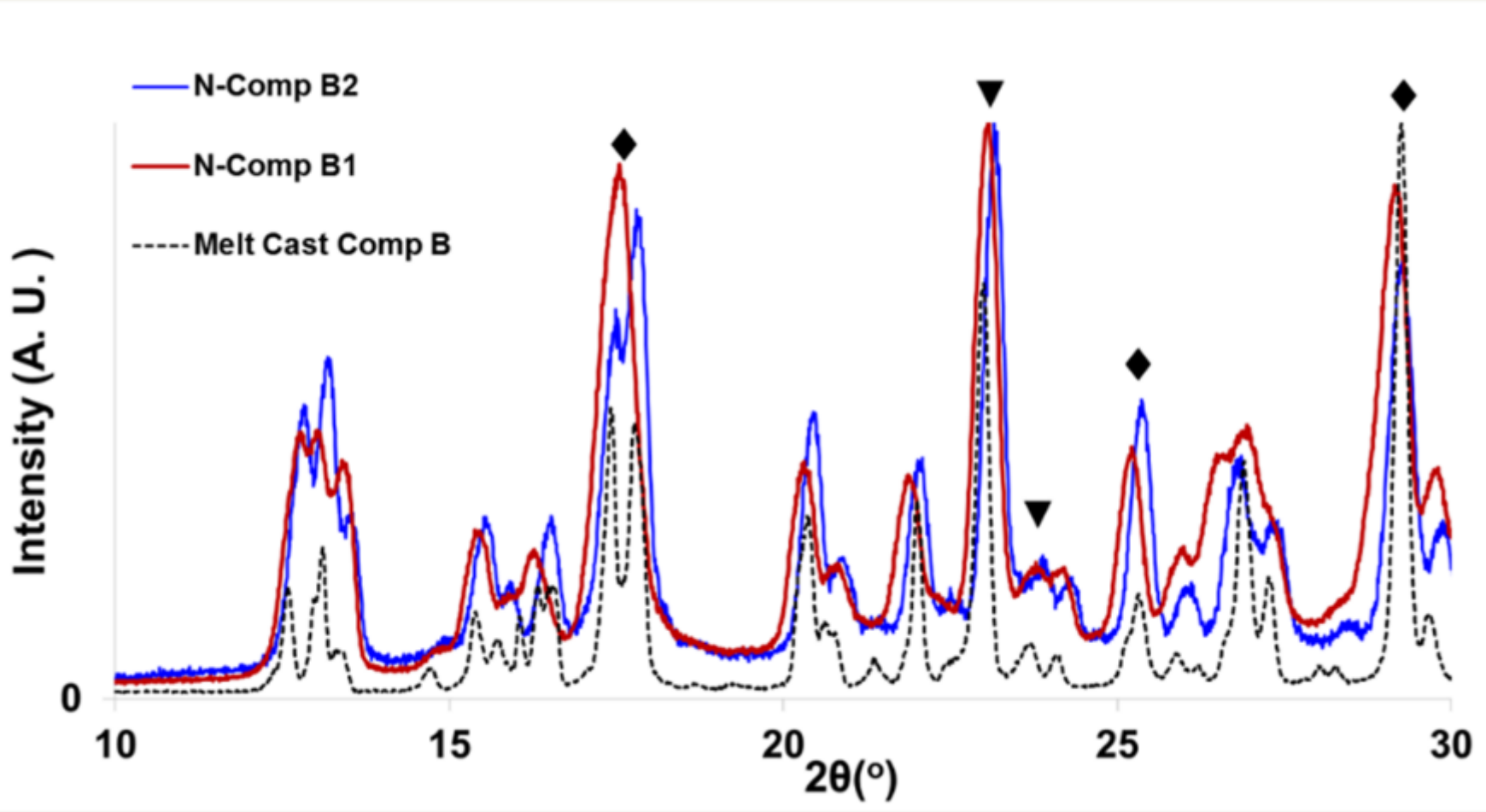


N-Comp B2



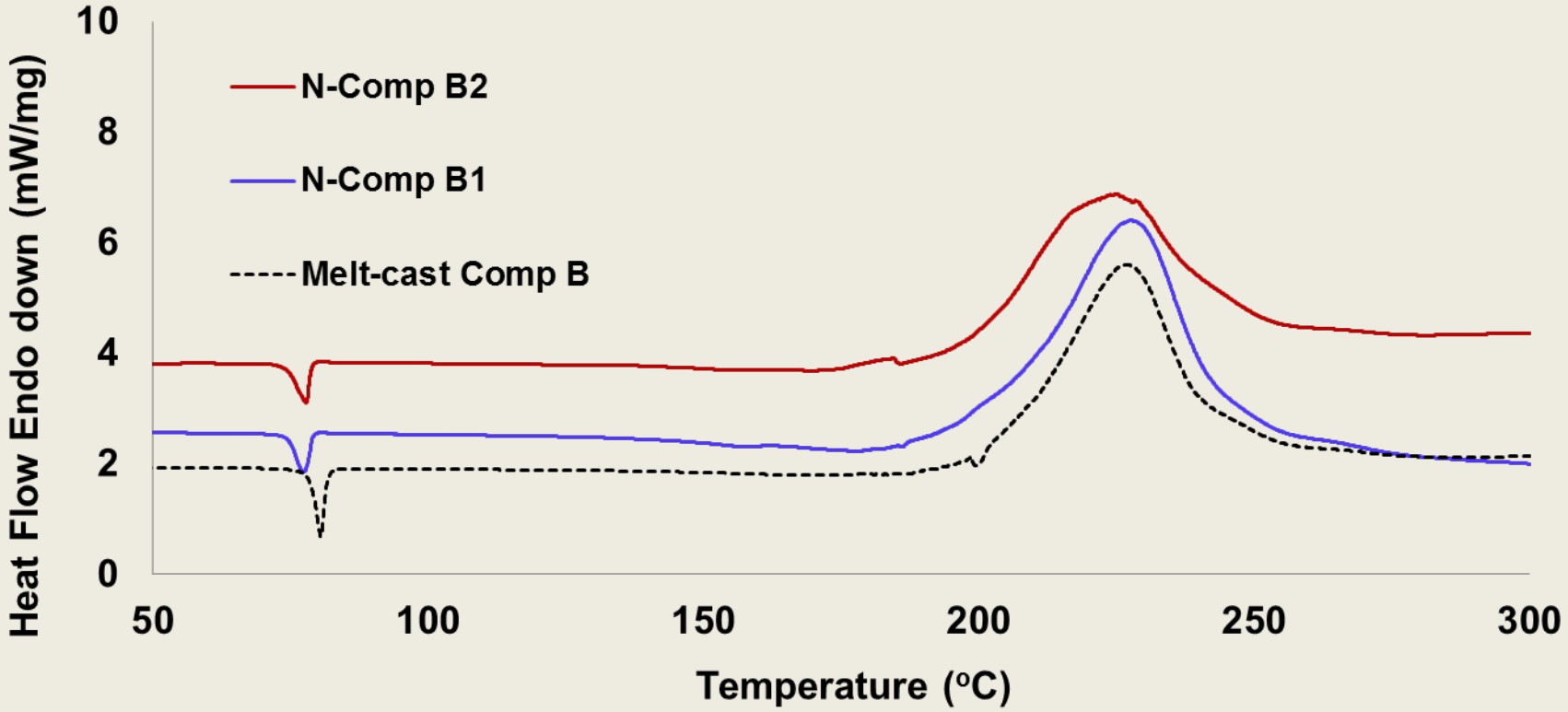


XRD Analysis of N-Comp B Molding Powder



◆, RDX and ▼, TNT

DSC Scan of N-Comp B Molding Powder

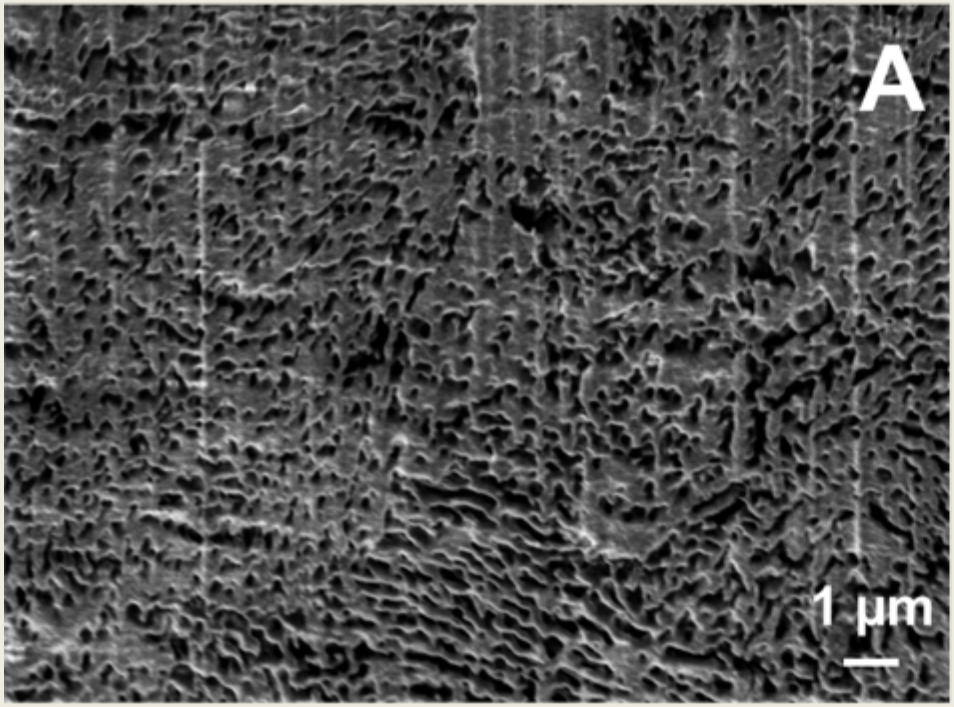


SAFETY TESTS

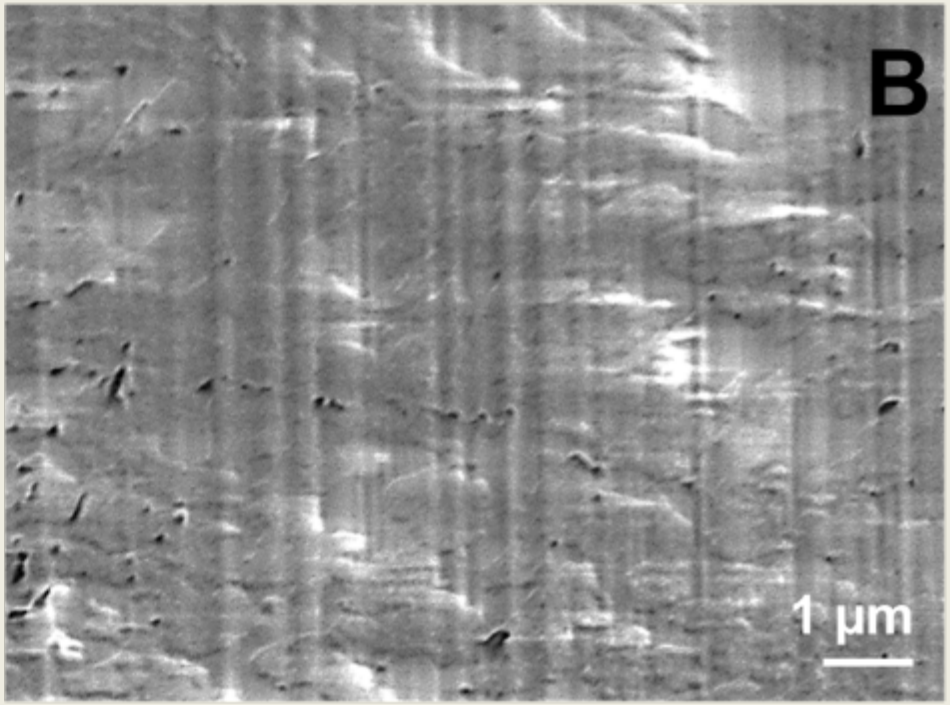
Samples	Impact (cm)	Friction (N, go/no-go)	ESD (J, go/no-go)
Comp B	33.9	318/282	-
N-Comp B1	51.6	252/240N	0.051/0.040
N-Comp B2	69.5	360N	0.040/0.031

CROSS-SECTIONAL SEM ANALYSIS OF N-COMP B

Compacted Pellets of N-Comp B1

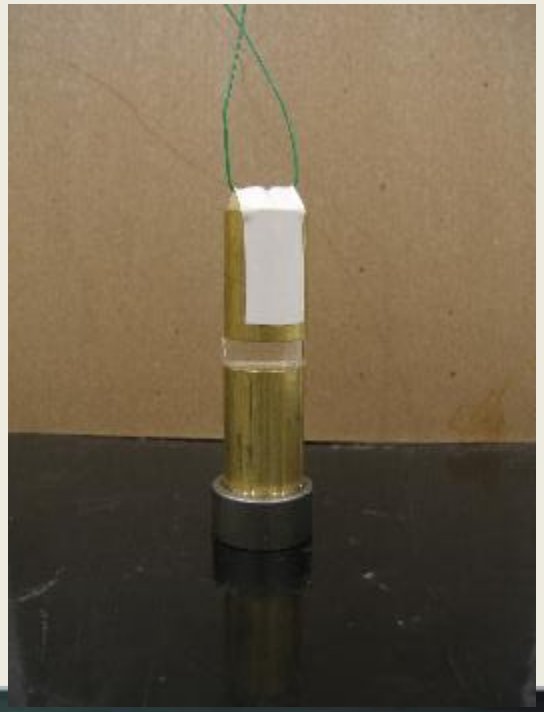


Compacted Pellets of N-Comp B2



SSGT Test Results

Samples	%TMD	SSGT Shock Sensitivity (%)
Comp B	95.2	100
N-Comp B1	94.8	116
N-Comp B2	98.4	150



CONCLUSIONS

- **Nanoenergetics-based Comp B (N-Comp B) consisting of nanoscale RDX and TNT crystals was prepared by spray drying and mechanical compaction.**

- **The addition of a polymeric binder during the spray drying process mediated the compaction and is demonstrated as an effective method to reduce the size and the number density of voids, leading to a sensitivity reduction.**

- **This work continues to demonstrate that the spray drying based materials processing method is a facile and versatile method for producing high performance and low sensitivity nanoenergetics-based explosives.**

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