

WHAT IS THE PURPOSE OF THE ENERGETIC MATERIALS RESEARCH LABORATORY?

Explosives come in all shapes and forms. In addition to the numerous military and commercial explosives, there are a large number of clandestinely manufactured explosives known colloquially as improvised explosives, or IE. Improvised explosives are a major concern because there are so many different recipes for making them and each has the potential to impart unique chemical and physical properties to the explosive.

The Energetic Materials Research Laboratory, or EMRL, studies the mechanical, electrical, and thermal properties of explosives—especially as they relate to sensitivity. Prior to manufacturing explosives for the purpose of testing explosives detection systems, EMRL determines whether it is safe to prepare and handle the explosive.

SMALL SCALE SAFETY TESTING

There is a suite of tests developed by the explosives testing “community” to determine the sensitivity of an explosive to external stimuli such as impact, friction, and electrostatic discharge. These tests are designed to compare an IE to a standard explosive, such as RDX—the main ingredient used in the military explosive C4. Because the properties of RDX are well understood, if the comparison shows that the IE is less sensitive than RDX, then the chemist or explosives handler can be reasonably assured that it is safe to prepare, transport, and test.

THERMAL PROPERTIES

Commercial and military explosives are known to be thermally stable, which means they will not start to heat on their own or explode when heated. Improvised explosives typically do not have the same stability. EMRL has the capability to measure the thermal properties of any explosive and determine the likelihood that it will be thermally unstable during preparation or handling.

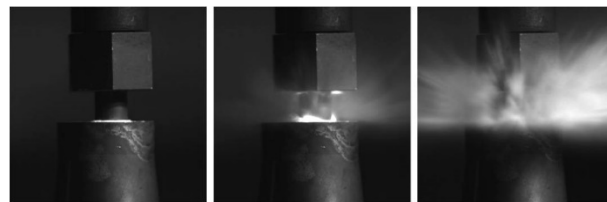
The analytical techniques used to measure thermal properties have names like differential scanning

calorimetry, thermal gravimetric analysis, and accelerated rate calorimetry, but are referred to by their acronyms: DSC, TGA, and ARC. Recent accomplishments include thermal stability testing of composite explosives to determine usability lifetime.

PREPARATION OF NEW EXPLOSIVES

Whenever there is an interest in a new explosive, EMRL can prepare, or “synthesize” the explosive in small quantities and assess the safety parameters. Without this assessment, larger quantities of the explosive cannot be prepared for testing by bulk detection systems.

The ability to characterize and scale-up new explosives allows EMRL to quickly respond to intelligence-based rapid response requests.



CURRENT PROJECTS

- Reduction in the subjectivity of safety testing by measuring carbon monoxide and infrared light emitted during testing
- Use of high-speed video to monitor safety testing

PARTNERS

EMRL participates in “round robins” with other laboratories and organizations. A round robin is when different labs perform an identical test and then compare results. In this way, differing results can be analyzed and discussed. Some laboratories in which the EMRL has participated in round robins are: Lawrence Livermore National Laboratory, Sandia National Laboratory, and Tyndall Materials Research Group.