



Mechanical Engineering

Basics of Energetic Materials

Course Introduction

Energetic materials refer to materials with a high amount of stored chemical energy such as propellants, explosives, pyrotechnic (PEP) compositions, and other fuel / oxidizer mixtures. Energetic materials are characterized by their ability to initiate a reaction from an energy stimulus and propagation and effect characteristics after ignition.

This training course is designed to provide participants with the basic behaviors of energetic materials, with focus on explosives. This course will discuss topics such as how energetic materials burn or detonate, the effects of detonation, and how they may respond to extreme environments, key terminologies defining the materials and behaviors, and handling issues related to processing, fabrication and testing aspects of explosives work.

Target Audience

1. Explosives & Propulsion Systems – Design and safety of energetic materials.
2. Mechanical Safety Engineering – Risk management in high-energy applications.
3. Defense & Aerospace Engineering – Integration into mechanical systems.

Learning Objectives

- Gain a comprehensive understanding of the different energetic materials such as pyrotechnics, propellants and explosives
- Recognize the differences in sensitivity and handling practices of primary and secondary energetic materials
- Identify the essential characteristics which make a material an explosive
- Know the differences between detonation, deflagration (“low-order”) and combustion

- List some of the most common industrial explosives and some typical improvised explosive fillers
- Understand what shock and detonation waves are, and how material flows behind a shock
- Appreciate how material stiffness affects shock and impact coupling into other materials
- Identify the reason for detonation failure in small columns of explosives, and know how that
- Distinguish between high-power vs. low-power explosive components, and know of safety issues with both
- Understand the basic characteristics of air blast and how it loads structures

Course Outline

• 01 DAY ONE

- The differences between pyrotechnics, propellants and explosives
- Types of main explosives being used in the mechanical and manufacturing industry
- Sensitivity and handling practices for primary and secondary energetic materials
- The three essential characteristics which make a material an explosive
- Detonation, deflagration (“low-order”) and combustion
- Some products of combustion or detonation
- Most common industrial explosives and typical improvised explosive fillers

• 02 DAY TWO

- Shock and detonation waves are
- How material flow behind a shock
- How shocks die away, and the role of sound speed in that process
- How material stiffness affects shock and the impact coupling into other materials
- Cause of detonation failure in small columns of explosives
- How detonation failure relates to the size of a detonator or booster required to initiate a given explosive

• 03 DAY THREE

- How thermal explosions may develop
- High-power vs. low-power explosive components

- Safety issues of high-power vs. low-power explosive
- Fragmentation, shaped charge and EFP warheads operations
- Characteristics of air blast and how it loads structures
- How certain mechanical and electrical environments may accidentally ignite explosives

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 23, 2025	June 25, 2025	3 days	3250.00 \$	UAE - Abu Dhabi
July 14, 2025	July 16, 2025	3 days	3250.00 \$	UAE - Dubai
Sept. 1, 2025	Sept. 3, 2025	3 days	3250.00 \$	UAE - Dubai