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Course Name

Basics of Energetic Materials

Sector Name

Mechanical Engineering

Document Type

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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 a 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.

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Basics of Energetic Materials

Target Audience

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

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Basics of Energetic Materials

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 that 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

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Basics of Energetic Materials

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 that 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

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Basics of Energetic Materials

Course Outline

✓ 02 DAY TWO

Shock and detonation waves are:

- ✓ How does 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

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Basics of Energetic Materials

Course Outline

✓ 03 DAY THREE

How thermal explosions may develop

- ✓ High-power vs. low-power explosive components
- ✓ Safety issues of high-power vs. low-power explosives
- ✓ 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

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
Sept. 7, 2026	Sept. 9, 2026	3 days	3250.00 $	UAE , Dubai
Jan. 17, 2027	Jan. 19, 2027	3 days	3250.00 $	KSA , Riyadh
July 5, 2027	July 7, 2027	3 days	3250.00 $	UAE , Abu Dhabi
July 26, 2027	July 28, 2027	3 days	3250.00 $	UAE , Dubai

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