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PRESENTATION ON

MECHANISM OF HOTSPOT FORMATION

CUFS 2416 EXPLOSIVE AND POST BLAST INVESTIGATION

B.SC. FORENSIC SCIENCE (SEM 6)
SCHOOL OF FORENSIC SCIENCES
BHUBANESHWAR CAMPUS

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- Formation due to friction
- Formation due to impact

INTRODUCTION

- The formation of hot spots in dynamically compressed, plastic-bonded explosives is known to be the primary mechanism by which these materials ignite and initiate, but hot spots are small, fleeting, and hard to observe.
- Using a microscope equipped with laser-launched, miniflyer plates, hot spots in small grains of HMX is observed.

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- Another source of hotspots is the presence of grit particles, such as crystals. When the particles are small and sharp only a small amount of frictional or impact energy is needed to produce a hotspot.
 - Soft particles are unable to generate enough energy to produce hotspots since they will be crushed or squashed.

FORMATION DUE TO FRICTION

- When an explosive is subjected to friction, hotspots are formed. These hotspots are generated by the rubbing together of explosive crystals that are present in the explosive composition.
- Hotspots readily form on the surface of the explosive crystals since they are non-metallic and have a low thermal conductivity. The temperature of the hotspots must reach temperatures greater than 430°C for ignition of the explosive material to occur.
- Explosive compositions containing crystals which have melting temperatures lower than 430°C will not achieve ignition through the formation of hotspots, whereas those compositions with crystals of high melting temperatures will form high temperature hotspots capable of igniting the material.

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- Hotspots which are generated by friction are transient and will only last for a very short time, i.e. 10 to 13 s.
 - Consequently, temperatures for ignition via hotspots is higher than conventional thermal ignition temperatures for explosive substances..

FORMATION DUE TO IMPACT

- When liquid explosives are subjected to high impact, compression and heating of the trapped gases takes place and exothermic decomposition of the explosive vapour begins. The rapid rise in temperature results in further evaporation of the liquid explosive from the walls of the bubble, creating hotspots.
- When solid explosives are subjected to high impact, hotspots are formed from the compression and heating of the trapped gases, and from friction between the crystal particles.
- Ignition for the majority of primary explosives is via hotspots generated by intercrystalline friction, whereas ignition of secondary explosives is from hotspots generated through the compression of small gas spaces between the crystals.

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- Hotspots which are generated by impact are transient and will only last for a very short time in the order of 10^{-6} s. Consequently, hotspots temperatures for ignition are higher than conventional thermal ignition temperatures for explosive substances.

THANK YOU.

