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PRESENTATION ON

# *ANFO-HISTORY AND DEVELOPMENT*

CUFS 2416 EXPLOSIVE AND POST BLAST INVESTIGATION

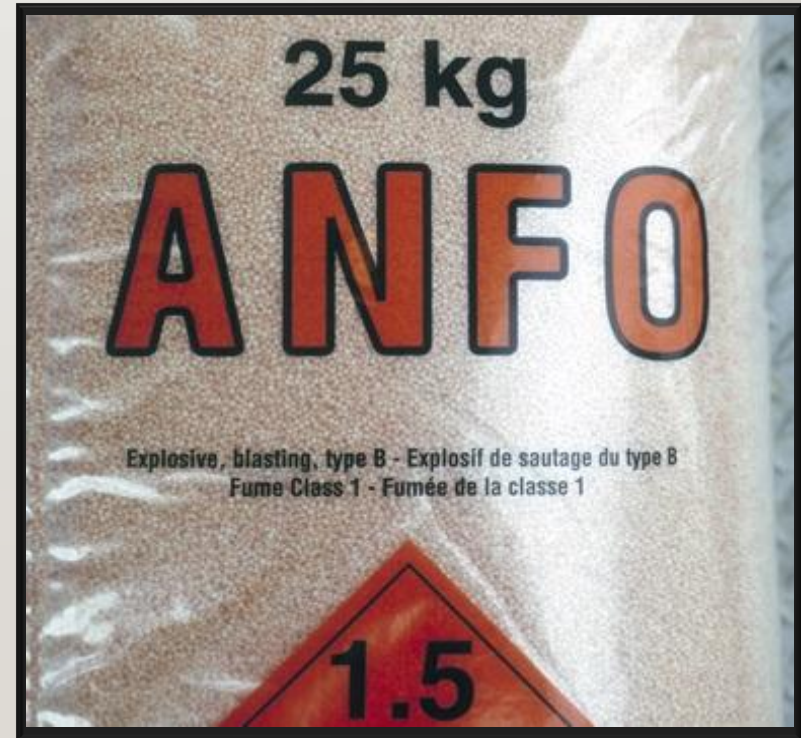
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B.SC. FORENSIC SCIENCE (SEM 6)  
SCHOOL OF FORENSIC SCIENCES  
BHUBANESHWAR CAMPUS

# INTRUDUCTION

Ammonium nitrate is a chemical compound with the chemical formula  $\text{NH}_4\text{NO}_3$ . It is a white crystalline salt consisting of ions of ammonium and nitrate. It is highly soluble in water and hygroscopic as a solid, although it does not form hydrates. It is predominantly used in agriculture and as explosive when mixed with fuel oil in mining industries

- AN is a weak explosive base, its explosion temp. being 1130 digree centigrade.
- Being oxygen positive , is often used as oxygen supplier in addition to being an explosive base
- The usual ANFO formulation contains about 94% by weight ammonium nitrate and 6% diesel fuel oil



# CONTENT

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- Introduction
- History and development of ANFO
- Chemistry of ANFO
- Properties of ANFO
- Applications
- Advantages and disadvantages

# HISTORY AND DEVELOPMENT

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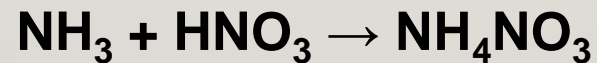
- Though ammonium nitrate was first synthesized in 1659 by German chemist Johann Rudolf Glauber, it wasn't used in explosives until World War I, when weapon makers mixed it with TNT (aka dynamite) to make cheaper bombs



# OCCURRENCE AND PREPARATION

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- The ammonium nitrate occurs through a natural process. It occurs as a mineral in certain desert regions of the entire world. However, it is not abundant and is present as a mixture with various other minerals
- We can commonly prepare the ammonium nitrate by the reaction of ammonia with nitric acid. This is a typical acid-base reaction to provide a salt ( $\text{NH}_4\text{NO}_3$ ) as the product that we will be getting after the reaction.



# PHYSICAL AND CHEMICAL PROPERTIES

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- Its physical state is in the form of solid and it typically exists as a white colour crystalline or a bead-like powder. It has a melting point of 169.6 °C. Whereas its boiling point is 210 °C, and it has a density of 1.72 g/cm<sup>3</sup>.
- Ammonium nitrate is readily soluble when putting inside the water (H<sub>2</sub>O). Moreover, it is also highly hygroscopic in nature which means that it readily absorbs the water from the atmosphere and bundles up. It is not particularly reactive and at the same time, it is fairly stable also. It decomposes at high temperatures that are over 200 °C. This temperature helps to make nitrous oxide and water vapor.

Properties	ANFO
Density (g/cm <sup>3</sup> )	0.90 – 0.95
Detonation velocity (m/s)	2000-2500
Detonation transmission (cm)	Contact
Oxygen balance (%)	+ 0.11
Gas volume (dm <sup>3</sup> /kg)	990
Heat of explosion (kJ/kg)	4250
Explosion temperature (K)	2700
Initiation	Pentolite booster 300g

# EXPLOSIVE PROPERTIES

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- $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2 + \text{O}_2 + \text{H}_2\text{O}$
- ANFO is **detonator-insensitive**, so it must be initiated by a primer.
- ANFO consists of distinct fuel and oxidizer phases and requires confinement for efficient detonation.
- ANFO has a density smaller than  $1.0 \text{ g / c m }^3$ , and it has bad water resistance.
- The detonation velocity varies from **3,000 to 4,000 m/sec** for the 1 to 10 pct range of fuel oil content

# APPLICATIONS

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- ANFO is one of the most widely used explosives in the mining industry, despite competing in the market with the much more efficient emulsion explosives (EEs). This is mainly due to its uncomplicated manufacturing technology, small number of its components, and low production costs compared to EEs



# ADVANTAGES AND DISADVANTAGES

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- ANFO produces less toxic fumes than dynamite
- Its main advantages are its low price and simple method of production.
- safety, economy, and ease of handling
  
- ANFO has also some disadvantages: It is not water-resistant; • Its density is low; • It is non-ideal reacting; and • It is not cap-sensitive and must be initiated with a primer.

**THANK YOU.**

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