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Platinum gauze. Picture credit: Heraeus

WOVEN PLATINUM

Gauzes made from platinum are instrumental to a range of industrial processes

Platinum catalysts were first used to make nitric acid from ammonia in the early 20th century in a chemical reaction known as 'the Ostwald process' after the pioneering work of Nobel Prize-winning chemist Wilhelm Ostwald in 1901.

Fifteen years later, Johnson Matthey, the global science and chemicals company, made a further breakthrough in platinum catalyst technology, selling the first woven gauze catalyst to the UK Munitions Inventions Department in 1916 to make nitric acid for explosives following the outbreak of the First World War.

Since then, the technology has continued to evolve. Gauzes made from platinum-rhodium alloys were introduced in the 1930s to increase gauze strength, reduce platinum losses and increase conversion efficiency.

In the 1990s, knitting technology allowed a diverse range of structures and alloys to be used, improving performance and reducing manufacturing time.

Today, ammonia and air are routed over platinum alloy gauzes heated to 900°C, producing nitrogen oxide that bonds with water to create nitric acid. This chemical reaction requires round knitted gauzes of up to six metres in diameter.

Growth sector

One of the main uses of nitric acid is in the agrochemicals sector – it is a feedstock in the production of fertiliser. The global market for nitric acid is currently around US$22.3 billion and growing – it is forecast to reach c.US$ 27.5 billion by 2025, due to rising fertiliser demand and crop output requirements.

Platinum catalysts in the form of a platinum-rhodium gauze are also employed in the manufacture of both caprolactam and hydroxylamine; these are intermediate compounds in the production of synthetic polyamide fibres, used in textiles.

As well as its catalytic properties, platinum's mechanical properties also make it especially suited to being woven into a gauze; it is ductile, meaning it can be easily pulled into long, thin wires. Its resistance to corrosion, oxidation and temperature are also important attributes.

Gauze catalysts are recycled at the end of their useful life. The individual components, such as platinum and rhodium, are carefully separated and the purified precious metals are then turned back into wires and used to make new gauzes.

Very little platinum by weight is lost in the production of nitric acid. While a new plant may be equipped with over a ton of platinum gauze catalysts, only a few per cent of this needs to be replaced when the gauze is periodically recycled.

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