The new RCF alternative that's reshaping the oil and gas industry

Gary Jubb, Fibre Centre of Excellence Lead at Morgan Advanced Materials discusses the use of RCF as a furnace lining and how the petrochemical industry is preparing for a change in the form of a new alternative.

Refractory ceramic fibre (RCF), also known as aluminosilicate wool (ASW), has long been the first-choice material for lining fired heaters in the oil refinery and petrochemical industries. Its excellent handleability, low thermal conductivity and heat capacity, superior thermal shock resistance, good resistance to pollutants and ability to withstand extreme temperatures makes it ideal for extending the life of fired heaters, increasing their energy efficiency, and increasing furnace reliability.

However, some in the industry are always looking for alternatives to RCF. EU regulations designed to address the health concerns of RCF and crystalline silica have required materials manufacturers to search for innovative solutions to put minds at ease and introduce furnace linings fit for the future.

Under the EU Carcinogen Directive, businesses are required to use substitutes to RCF where it is technically and economically feasible to do so. However, these requirements are open to interpretation and until recently, no material has been able to match the superior insulating performance and high melting point of RCF.

Replacing RCF- A balancing act

For many oil refinery operators, replacing RCF with other alternatives will negatively affect furnace operations so is an unpopular option. A typical furnace can generate anything between £100,000 to £1m worth of product in a single day; a figure which leaves many operators having to weigh up the pros and cons between their bottom line and complying with EU regulation.

On the opposite face of the coin, many operators value their green and ethical approach. Some are maintaining the fired heater's lining to extend its lifespan rather than replacing it, in the hope that a viable RCF alternative will be made available. However, this conscious decision may be taken at the expense of an efficient and high-performing furnace.

From 2020 onwards, producers and users of RCF in Europe will have to keep the amount of RCF fibres in the workplace <0.3 fibres/ml. Many other countries around the world have also imposed similar stringent controls. Such controls make using RCF difficult and expensive. Disposal of RCF is also becoming expensive, requiring special landfill sites.

This is compounded by the increasing commitment of major industrial companies and trade associations to improve 'green' standards and places the onus on the fibre industry to find viable alternatives that match the performance of RCF. For example, RCF has been more resistant to attack by alkali-based pollutants than the existing low biopersistent fibre compositions and that has limited the replacement of RCF in many applications.

A unique alternative to RCF is born

In recent years, Morgan Advanced Materials has been using its Fibre Centre of Excellence in Bromborough, UK to conduct research into RCF alternatives. Instead of attempting to make marginal gains in low biopersistent performance, Morgan has flipped its approach and revisited RCF itself. The ideal outcome has been to produce a new fibre with all the great performance of RCF but has low biopersistence and uniquely does not form crystalline silica during use. As a result, Morgan's Thermal Ceramics business has recently launched a material that performs in a similar way to RCF without the inherent environmental, health and safety (EHS) risks associated with it.

Superwool® ***XTRA*** is unique in that it does not form crystalline silica - a major revolution for the industry. In terms of its effect on EHS, Morgan's breakthrough material is exonerated from any carcinogenic classification under Nota Q of Directive 97/69EC.

From strength to strength

Superwool® insulating fibre was first launched in the 1990s. Since its launch, it has become well-recognised for its low biopersistent (LBP) properties that minimise health risk to furnace installers, operators and other factory employees. Fast-forward to the present day, the Superwool® family has developed significantly.

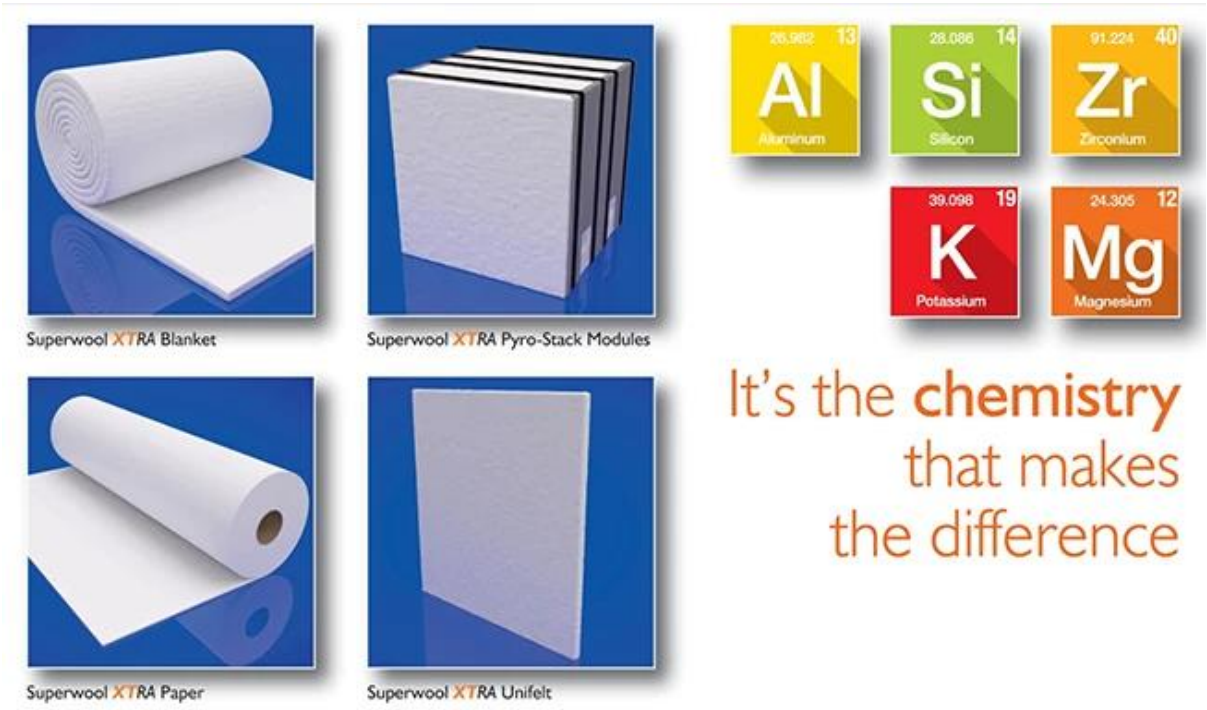
The latest in the Superwool® chapter, Superwool® ***XTRA***, delivers the strength that industrial applications need. This is both in terms of its resistance to high temperatures and pollutants, but also its improved EHS credentials.

Tried and Tested

Superwool® ***XTRA*** was the culmination of almost a decade of research and development, plus almost four years of stringent testing in specified applications with customers.

Crucially, petrochemical operators are guided by the American Petroleum Institute's (API) standards. The API's classification temperature which is to be used for insulation outlines an obligatory 150°C overtemperature capability on the fibre within furnaces.

Critical furnaces within the oil refinery and petrochemicals industry run between 1200°C and 1250°C (2192°F and 2282°F) and therefore require materials with a 1400°C (2552°F) minimum classification rating. With a classification rating of 1450°C (2642°F), Superwool® ***XTRA*** offers a performance equal, and in many cases superior to RCF.



Making the switch

Identifying the need for a new furnace lining is not an easy task as testing and trialling new materials can cost upwards of £30,000 per trial, not to mention furnace downtime. However, ensuring lining quality is essential for protecting personnel, minimising heat loss and maintaining operational reliability.

Furnace linings which may have developed cracks over time are prone to increased thermal loss; some of which may not be visible from the outside. To minimise costs, it is

recommended that testing coincides with the scheduled downtime, so fabricators can swap-out and install the new lining.

One technique for identifying thermal losses lies in the use of infrared (IR) thermography scans. By using these IR scans, engineers can keep the furnace in operation while conducting an analysis. If a hot-spot leak is found, if possible it is always advisable for the repair to be done on-line to minimise business impact.

Consider engineering design carefully

To achieve maximum efficiency for the materials specified during the furnace relining process, it is critical to ensure the engineering design is appropriate.

Not only must the materials have enough studs to hold them in place, they also require sufficient joints for expansion or shrinkage. If a brick lining is installed without adequate expansion joints, the brick can grow so large that it pushes the entire lining off the furnace wall. This will lead to further inefficiency, requiring the entire process to be repeated.

Over long periods of time at temperature fibre modules degrade resulting in shrinkage gaps between the modules. These normally need filling with more fibre during scheduled maintenance shut-down periods. With Morgan's Superwool® ***XTRA***, the fibre is innovative in that it expands when heated to high temperatures such that any shrinkage gaps remain closed. This expansion is reversible so when it cools down, the shrinkage gaps become visible. However, unlike other fibres, there is no need to fill the gaps saving on labour costs, material, and loss on down-time.

Trust the professionals

A new furnace lining which uses the right materials, is designed to requirement, and installed correctly, can last for as long as 20 years, therefore, ensuring it performs efficiently and reliably is imperative. With a vast range of furnace lining products available on the market, each requires unique installation methods, so it is important that the personnel employed to carry out the work are highly skilled and experienced. Failing to do so can lead to complications, excessive down-time and result in large sums of money being lost.

Additionally, degradation of furnace insulation can result in development of hot spots on the casing that can damage equipment and cause an unsafe condition for personnel. It can also disrupt the process as operators compensate for the higher heat loss. In turn, the furnace can develop hot spots which if located near its tubes, could cause serious damage. This can be extremely dangerous, as the materials in these tubes are highly flammable. If the tubes break, there is a significantly heightened risk of an explosion.

A brighter future

The industry's search for an RCF alternative is now over and a low biopersistent future for refineries and petrochemical plants has arrived in selected applications.

Superwool® ***XTRA*** has proven itself through considerable testing and real-world applications to be a viable alternative to RCF, with no loss of thermal performance. In addition to its efficiency credentials, the product's improved EHS performance and lack of crystalline silica

as a by-product have alleviated worries from operators and installers at petrochemical sites. It is available in multiple forms and able to provide low-biopersistent thermal insulation to the iron and steel, glass and ceramics industries as well as the chemical processing and oil and gas sectors.

For more about Morgan Advanced Materials and how Superwool® ***XTRA*** can answer your concerns about furnace and refractory performance, please visit:
http://www.morganthermalceramics.com/SuperwoolXTRA