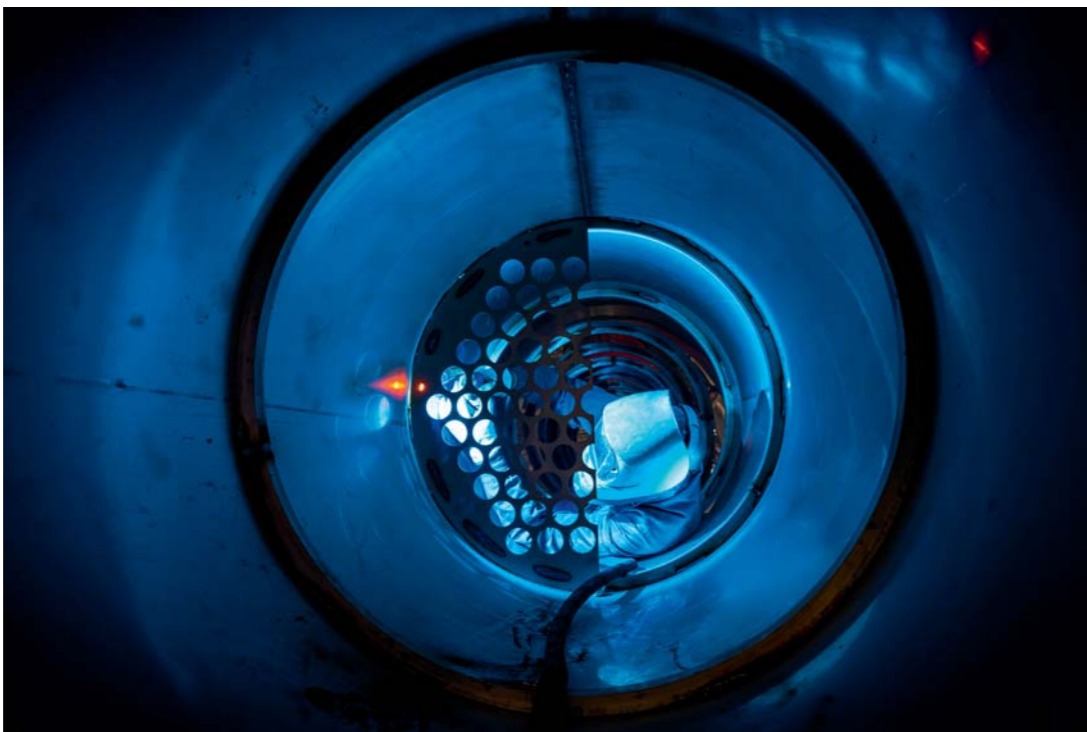


Sandvik Materials Technology: Unparalleled innovative alloys for demanding applications

Part of the Sandvik Group, Sandvik Materials Technology is a world leader when it comes to innovating, developing, and manufacturing advanced stainless steels and special alloys for very demanding environments, and systems for industrial applications. Its business history dates back 150 years, attributing to an unparalleled level of experience and expertise. Today, the company has a strong industry position across a multitude of end-user markets with leading players.



➤ Sandvik has an extensive manufacturing program for seamless heat exchanger tubes.

By Ellie Pritchard and John Butterfield

To understand more about the company's continually expanding material solutions for heat exchanger applications, Heat Exchanger World spoke with Barinder Ghai, Regional Technical Marketing Manager, EMEA, and Jari Ponsiluoma, Product Manager for Heat Exchanger and Fertilizer Tube, EMEA.

Innovation is key, as with Safurex® and Sanicro® 35

Sandvik's materials are built for the most demanding environments, ranging from sea water to offshore to geothermal applications, the latter being a new area for the company. In these extreme conditions, customers require parts that are reliable, durable, and low maintenance to avoid the financial costs of downtime. For this reason, Sandvik continuously develops and adapts its materials, believing that there is always an opportunity to perfect further. "It is all about improving lifetime," says Mr. Ponsiluoma. "We are involved in some of the most challenging projects worldwide, and this is where our knowledge, experience, and expertise really come into play." In the urea industry, for example, carbamate corrosion poses a particular challenge as the fertilizer process produces ammonium carbamate, which often causes extensive and relatively rapid corrosion even among many different grades of stainless steel. To combat this, Sandvik and its long-term partner Stamicarbon developed a highly corrosion-resistant material called Safurex®. It

was created by combining Sandvik's specialist knowledge in high-alloyed stainless steel and Stamicarbon's expertise in the fundamentals of carbamate corrosion. Safurex® has not only proved to be highly corrosive resistant, solving 80% of all corrosion issues in instances of its application, it also allows a significant reduction of passivation air (80% proven), and can be operated without oxygen (although at an increased passivation corrosion rate). Safurex® does not corrode actively, also without oxygen, and has effectively led to 1.5 million years of heat exchanger tube usage without rupture, a gargantuan achievement. Other additional benefits to plant operators are that Safurex® has higher process safety, provides a higher yield for the plant since there is less inert gas in the process, leads to less maintenance and inspection costs, has higher flexibility in operations in blocking-in and start-ups, and is less sensitive to upset conditions. Barinder Ghai further expands on these benefits: "Once you install equipment made from Safurex®, you don't need to change it, and you don't normally need to factor in stoppages or maintenance. This type of result is something that Sandvik knows is desired by end-users in the heat exchanger industry."

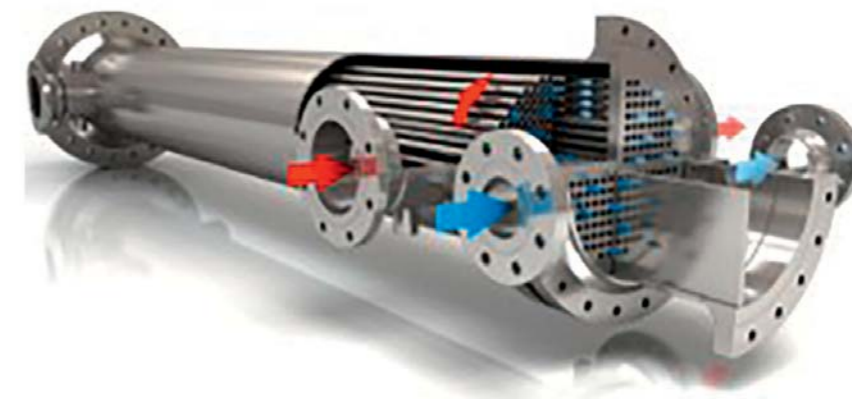
However, the Sandvik team didn't stop there with Safurex®. Barinder Ghai continues: "We have not stopped improving this grade and over the last three years we have gone on to develop the new grade, Safurex Star®." The company has now made the material into a brand as it is ideal for use under high-pressure industrial conditions and can considerably help to reduce plant investment costs. Moreover, thanks to a close relationship with the com-

pany's end-users, Sandvik can draw from its customer's experiences and use these insights to better understand market requirements. "Even with this degree of refined metallurgy we still continue to look for improvements so that the material can further enhance the lifecycle of equipment. This is Sandvik's strength, where taking an innovative approach is key. With every grade, we always work to enhance it," adds Jari Ponsiluoma. "We don't just believe in selling a material, we believe in adding value for our customers to extend their profitability."

Material highlights

In recent years, Sandvik's material highlights have been numerous. Its lean duplex SAF 2304®, for instance, developed for the ammonia industry has enabled the lifetime of ammonia condensers and interstage coolers to be extended by 10-12 years. Similarly, SAF 2507®, created for sea water coolers, has proven to be a cost-effective solution and an ideal replacement for cupronickel and admiralty brass alloys facing erosion-corrosion at relatively low rates. Sanicro® 28 has been/is used to successfully replace Alloy 825 in applications where the latter is used, and its possibilities are currently being explored for usage in Reactor Effluent Air Coolers (REACs). Further, SAF 2707HD™ is successfully used in applications requiring an enhanced resistance at critical pitting temperatures and crevice corrosion temperatures.

It is, nevertheless, Sanicro® 35 that has defined the past year for Sandvik. Launched in August 2020, its development dates back to 2012 and was Sandvik's response to the industrial market's need for a stainless steel alloy that combined corrosion properties with high mechanical strength (a super austenitic stainless steel, having a combination of high yield strength, resistance to severe acidic conditions, and excellent pitting and crevice corrosion resistance). The resulting grade has mechanical properties comparable to duplex grades and a corrosion resistance equivalent to high nickel grades. Prior to its development, Alloy 625 was regularly specified, for example, for severe heat exchanger applications such as REACs. However, it is



➤ For heat exchangers, Sanicro® 35 offers a smarter choice compared to other austenitic or super-austenitic steel grades and nickel alloys.

a costly material and one that requires regular replacement. Sanicro® 35 thus bridges the gap between super austenitic steel grades and the more expensive nickel alloys grades such as 6Mo and Alloys 625, providing a high-performance alternative to conventional material grades. In this way, it has been possible to support more cost-effective and efficient operations. Certainly, a key differentiator in its development was its unique combination of chromium, molybdenum, and nickel that distinguished it from existing 6Mo super austenitics. "What is very pleasing is that the first positive responses have come in about its use in a refinery in North America," says Barinder Ghai. "In the future, I believe it will be a game-changing grade because you can mix and match it with equipment made from other grades in process equipment depending on the needs and specific situations."

Full control, full independence

Mr. Ponsiluoma is keen to stress that, as well as Sandvik's constant search for innovation, the company's tube production process is undoubtedly something that sets them apart from their competitors. "It is unique in that



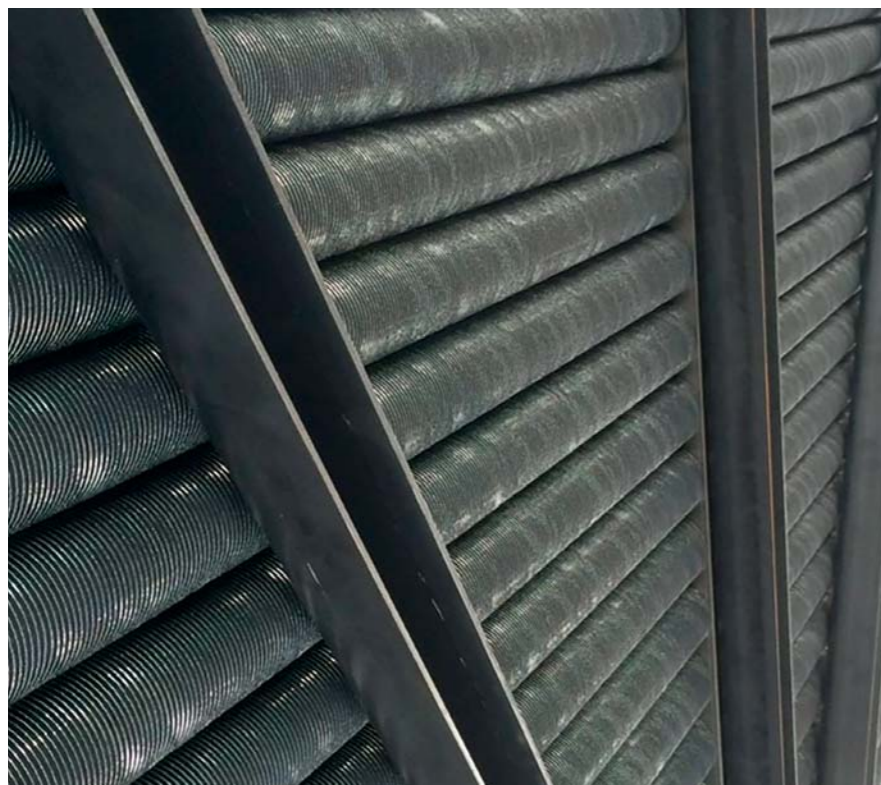
➤ Designed for service in aggressive corrosive environments, Sanicro® 35 bridges the gaps between standard duplex or austenitic grades and nickel alloys.



➤ Sandvik state of the art melting AOD process.

we have full control over the whole production process, from melting, where we use 82% recycled steel, through to alloying in the electric arc and high-frequency furnaces, the Argon Oxygen Decarburization (AOD) converter and the continuous casting plant, right on through to finishing operations such as cold rolling and cold drawing, or heat treatment. Additionally, we use quality management systems in our production processes that are approved by internationally recognized organizations. On the R&D side, we have one of the largest steel research centers in Europe."

As such, new materials are constantly being created and existing materials and production processes improved. On top of this, the company employs a comprehensive program of liaison and cooperation with universities, research institutions and specialized companies with



➤ SAF 2707 HD™ Hyper duplex tubes, atmospheric crude oil distillation - overhead air cooler.

exceptional expertise. Sandvik Materials Technology also continues to make investments to innovate and establish materials for demanding applications. It is these types of investments that will continue to form the backbone of company success into the future.

"Effectively," says Barinder Ghai, "we can be seen as being at the center of our own vast web; working together with all aspects of industries to ensure the best possible service for our customers and for end-users working with their products."

"The whole chain is important," confirms Jari Ponsiluoma, "and this means working together with process licensors, end-users, EPC contractors, to have a genuine understanding of current corrosion issues and gaps in the industry to meet new industry challenges and demands."

Sandvik and heat exchangers applications

"Choosing the correct materials to enhance heat exchanger lifetimes is never an easy decision," says Barinder Ghai, "and wrong material selection can lead to shorter lifetimes of equipment, excessive costs, increased downtime, and even health and safety issues." It is therefore not surprising that the Sandvik Materials Technology technical marketing and sales teams pay great attention in helping their customers select optimum grades for their applications with knowledge based upon their extensive service experience, which has been gained from worldwide installations.

"The most expensive solutions on offer are also definitely not always the best solution for a company," adds Mr. Ponsiluoma. "What is particularly important is that the selected grade needs to have sufficient corrosion resistance combined with suitable mechanical and physical properties."

In seawater coolers, for example, choosing the correct grade is critical as seawater contains large amounts of sodium chlorides and solid particles such as silt and organic solids. In such severe environments, a grade is needed that has a high resistance against both localized corrosion and erosion-corrosion, such as SAF 2707 HD™.

"In today's oil refineries the process streams involve many corrosive elements that can shorten the life span of low-alloyed steels. This is because refining consists of many complex processes in which the heat exchangers operate under severe corrosion conditions.

"Most leakages occur because of corrosion in the tubing," says Jari Ponsiluoma. As such Sandvik has created several grades to provide solutions in such situations: SAF 2205™,

Sandvik's product offering for heat exchangers

Sandvik has an extensive manufacturing program for seamless heat exchanger tubes covering most types of standard austenitic, duplex (austenitic-ferritic) and high-alloy austenitic stainless steels, as well as titanium and zirconium. Produced in imperial and metric dimensions, the tubes range from 12 mm up to 40 mm outside diameters, and straight lengths up to 30 meters or as U-bends. Additionally, special sizes can be made to order.

SAF 2507®, and SAF 2707 HD™. These grades are used in a large variety of applications such as overhead condensers, effluent coolers, feed preheaters, water coolers, air coolers, reboilers, condensers, evaporators, strippers, as well as in salt evaporation, power generation, and gas processing.

The road forwards

Sandvik Materials Technology has set out a clear direction for the future in which it intends to use its position as a technology leader, a progressive customer partner, and a sustainability driver to become an even stronger and independent company. Jari Ponsiluoma: "Just as we did yesterday and today, we will continue to focus on what has made us successful – helping our customers get better, more efficient, and productive in their processes. This will involve fully integrating sustainability into our offerings and operations and systematically collecting data about new and growing challenges faced by our customers." In this respect adds Barinder Ghai, "We will continue to work closely with our customers to jointly discover ways of addressing their challenges with new and modified tubular products, and finally, developing advanced materials that can make industrial



➤ Sandvik's highly integrated and sustainable production.

processes more efficient, profitable, and safer. Moreover, as we work towards providing sustainable solutions in all aspects of our work, we strive to provide a greener and better environment for all."



➤ Barinder Ghai, Regional Technical Marketing Manager, EMEA.



➤ Jari Ponsiluoma, Product Manager for Heat Exchanger and Fertilizer, Tube, EMEA.

Duplex vs. carbon steel in heat exchangers

The use of more expensive duplex stainless steels when designing heat exchangers can effectively be cost saving in the long run because of the combination of high-mechanical strength, superior corrosion resistance, and the fact that the fabricating compatibility of duplex stainless steels makes it possible to reduce the wall thicknesses of tubes, resulting in the design of lighter equipment. In fact, the best way to compare lifecycle costs of equipment is to compare what the outcome would be using the next best alternative grade, for example carbon steel or a stainless steel/special grade as both long- and short-term options.

Short-term carbon steel option

Low initial cost
Increased inspection costs
More frequent maintenance required
More frequent replacements required
Greater risk of production stoppages

Long-term stainless steel/special grade option

Higher initial costs
More reliable operations
Less frequent maintenance required
Less frequent replacements required
Lower lifecycle costs