

Nippon Yakin Kogyo:

Creating high-performance stainless

Nippon Yakin Kogyo Co. Ltd. was founded in Japan in 1925. Ten years further down the line and the company began providing industry with SUS 304 type stainless steels. From the outset, the company's dedication to research programmes and its ability to combine them into production processes led to it evolving a complete line of products from nickel ore to high-grade stainless steels and super alloys. Moreover, supported by a long tradition of excellent workmanship and outstanding technologies, Nippon Yakin Kogyo Co. Ltd has, over the years, created a state-of-the-art production system backed by precision quality control that ensures every product the company produces lives up to its high reputation standards. Today, the company is a top-notch manufacturer in Japan's stainless steel industry and a global leader in the production of high-performance alloy flat products. It continues to move toward the next generation fields of application as it challenges the possibilities of stainless steels and nickel alloys with new technologies, as we were to learn in our recent interview with them when they talked about some recent applications of their high-performance alloys.

By John Butterfield

Focusing on high-performance alloys

Nippon Yakin Kogyo Co., Ltd. is a Japanese manufacturer of flat products in a wide range of materials covering not only conventional stainless steels such as type 304 and type 316L but also high-performance alloys such as super stainless steels, nickel alloys, and Fe-Ni alloys.

The company has two plants – Oheyama and Kawasaki. The Oheyama plant smelts nickel ore to produce ferro-nickel, which is then used as a raw material in the Kawasaki plant. The Kawasaki plant is an integrated mill, which handles all processes from the melting of raw materials right through to the finished products. This is achieved using sophisticated equipment and outstanding technologies. Since the commercialization of type 304 stainless steel (18Cr-8Ni) in 1935, Nippon Yakin Kogyo Co., Ltd. has grown to be a production leader in the making of stainless steels in Japan. Moreover, against a backdrop of an ever increasing demand for high-performance alloys, Nippon Yakin Kogyo Co., Ltd. has concentrated its attention on the business of producing high-performance alloys in addition to making conventional stainless

steels since the beginning of 2000. Certainly, it has positioned itself well, particularly in the first mentioned field of operations.

Nowadays, Nippon Yakin Kogyo's high-performance alloys are used by many customers in a wide range of applications such as in the thermal, nuclear, chemical and petroleum, oil and gas, and the food processing industries. According to statistical data from 2010, the company currently ranks number two in the world in the production of nickel alloy flat products containing more than 30% nickel.

Sale of high-performance alloys

The market for high-performance alloys is expanding worldwide and the company has turned to North America, Asia and Europe as important regions for their sale of these products. To facilitate their ambitions in America, Nippon Yakin America, Inc. was established in Chicago in 2010 in order to strengthen their market research in this region of the world and, at the same time, to improve their sales support and technical support to their customers there. Currently, the USA office works according to a two-pronged strategy whereby it: (1) actively seeks out potential customers in the region as well as (2) providing strong support programmes to exist-

ing clients. The activities of the Chicago office will certainly increase the sale of their high-performance alloys in the USA. However, the Chicago office is not the only one that Nippon Yakin Kogyo has abroad since staff also work out of London, Shanghai and Bangkok. The tasks of these offices also include research into the local and regional stainless steel and alloy markets in order to expand business and promote company sales throughout Europe and Asia. Likewise, the recent establishment of the USA Office in Chicago has done much to strengthen the company's global network between Japan, USA, Europe and Asia, and thereby help to reinforce and further build upon the company's worldwide sales activities.

High-performance alloys in high-temperature applications

The heat resistant alloys produced by Nippon Yakin Kogyo are used in a wide range of applications covering everything from heavy industries to household appliances. The company has also become active in the solar power generation industry as the demand for energy produced in this way increases. This growth is largely due to the public's increasing awareness and attention to environmental protection.

For the uninitiated, solar power generation is a method by which sunlight can be directly converted into electricity using solar cells. The manufacturing process of polycrystalline silicon – a raw material of solar cells – involves managing chemical reactions at high temperatures and pressures. As a result, superior heat-resistant alloys are needed for the production of the reaction vessels used in the process, and Nippon Yakin Kogyo supplies these. An examples is UNS N08810 (32Ni-20Cr-Ti, Al). These alloys are characterised by the fact that they can withstand very aggressive chemical environments and are particularly suited to work at high temperatures. Although there are many reaction vessel manufacturers in China and Korea, we were told during the interview that "Nippon Yakin Kogyo holds a dominant share of the market in these regions".

Another representative heat resistant alloy UNS N08800 (32Ni-20Cr-Ti, Al), which is produced by the company has excellent resistance to high-temperature creep and oxidation, and is mainly used as a sheathing material for heaters in household kitchenware. A sheathed heater being comprised of a metallic sheath that acts as a cover tube, a heating coil placed within the sheath cover, and an insulation powder filling the sheath. The sheathing material needs to be resilient to high-temperatures because the sheathed cover itself will also be heated to high temperatures.

High corrosion-resistant alloys and their applications



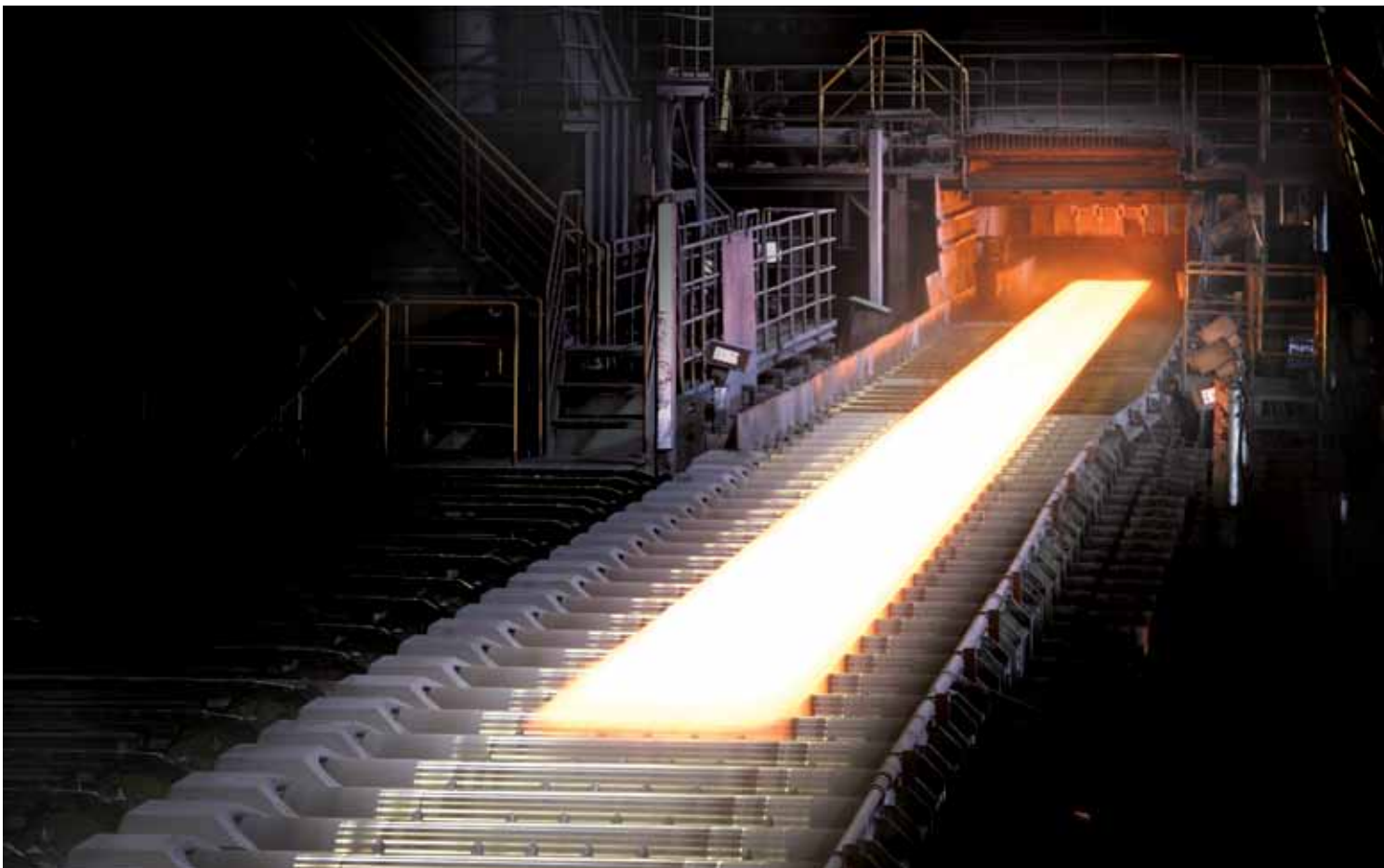
The highly corrosion-resistant marine structure of the Haneda Airport.

Chloride environments that exist, for example, in marine structures, or in flue gas desulfurization equipment in thermal power plants, or in soy source and salt manufacturing plants, are also very corrosive to conventional stainless steels. It is therefore with pride that Nippon Yakin Kogyo's staff relate that the company's high corrosion-resistance alloys are particularly applicable to these environments.

Last year, the forth runway of Tokyo International Airport (Haneda Airport) was built offshore from the main airport. Two types of Nippon Yakin Kogyo high corrosion-resistant alloys were selected for the lining of the legs of the piers – UNS S31254 (20Cr-18Ni-6Mo-0.8Cu-0.2N) and UNS N08354 (23Cr-35Ni-7.5Mo-0.2N). UNS S31254 was used to cover the piles of the piers in the tidal zone, where materials are not only exposed to tidal waters, but also to the spray zone, which is above the tidal area. UNS N08354, which offers superior corrosion resistance, was used to cover the upper parts of the piles where rain does not wash away corrosive adhering sea salt.

UNS N08354 is one of Nippon Yakin Kogyo's proprietary high-performance alloys. It has a higher corrosion resistance than 6% Mo super austenitic stainless steels such as UNS S31254, N08367, and N08296, because it contains 7.5% molybdenum. It is also more cost effective than nickel alloys. Therefore this alloy is produced for making heat exchanger plates exposed to sea water.

Flue gas desulfurization units are used to prevent air pollution in thermal power plants. Nippon Yakin Kogyo has been supplying super stainless steels UNS S32053 (23Cr-25Ni-5.5Mo-0.2N), UNS N08354 and certain nickel alloys N06022 (57Ni-31Cr-14Mo-3W), N10276 (59Ni-15Cr-16Mo-4W) for use in the



The NCH hot rolling mill, one of the very sophisticated pieces of equipment in the Kawasaki plant.

steels with a fresh perspective

building of flue gas desulfurization units as they have a good resistance to the high chlorine concentrations that accumulate in them.

Round-dot patterned stainless steel plate

Nippon Yakin Kogyo's products are not only high-performance alloys. They also include stainless steels with high value-added qualities. Round-dot patterned stainless steel plates made of Type 304 stainless steel – the 'Polka Plate' – is one of these products.

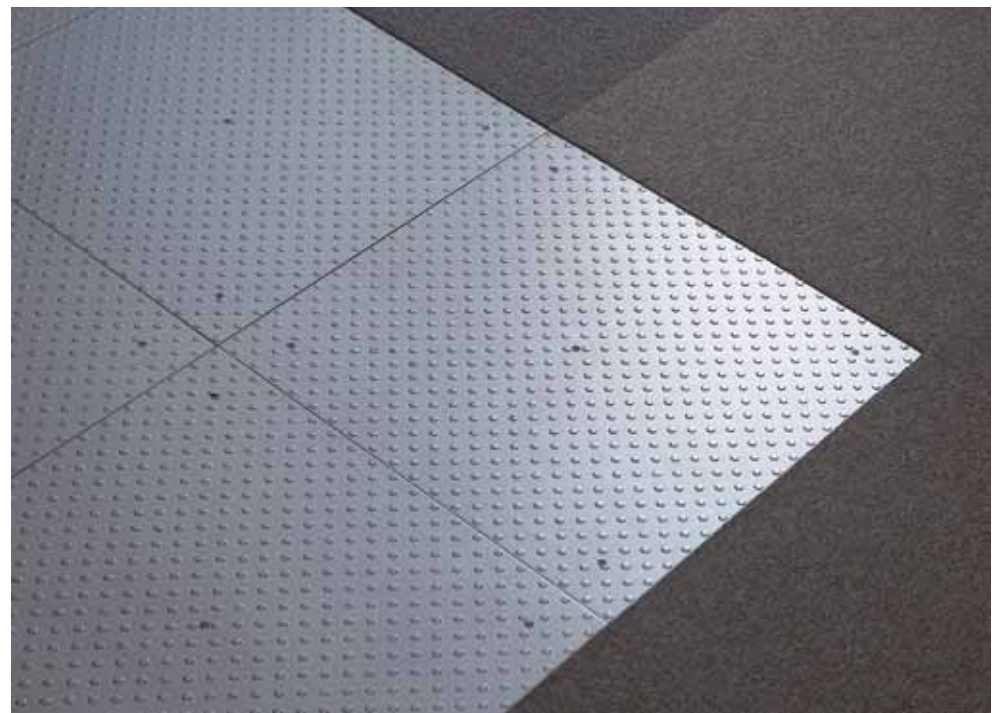
Checker patterned stainless steel plates are often used for flooring purposes because of their high slip resistance and good corrosion resistance. However, end-users sometimes complain about their cleanability, and the fact that they are not specially comfortable

to walk and stand on for long periods. 'Polka Plate' stainless steel floor plates were purposely developed to overcome these two factors. Further, because the 'Polka Plate' does not accumulate dust and water, it is easy to clean. Moreover, as the top of the round dot is relatively flat, the contact area of the 'Polka Plate' with the soles of shoes is greater than that of

the 'Checker Plate'. Therefore, the shock and stress that people feel through the soles of their shoes when walking and standing on the Polka Plate are lower, thus increasing a feeling of comfort. In addition, the 'Polka Plate' has a high-slip resistance because of its greater contact area with the soles of shoes. The slip resistance test, in accordance with DIN standard 51130, revealed that the 'Polka Plate' has the highest level of anti-slip performance, superior to checker patterned floor plates and the ASTM standard pattern B checker plate. The corrosion resistance, heat resistance, workability and durability of the 'Polka Plate' are almost the same as Type 304 plates because the 'Polka Plate' is in fact made of this material. With its aesthetic appearance, easy cleanability, and slip resistance, the use of this floor plate has been rapidly expanding in Japan.

The future

The path therefore seems to be set out for Nippon Yakin Kogyo and it will carry on growing as a global leader of high-performance flat product alloys both now and in the future. Without doubt the company will continue to work on the development of new alloys with enhanced properties that will encroach into every aspect of our daily lives. "We will continue to find new ways to meet the needs of the twenty-first century. Our new alloys will not only exceed conventional limitations of high-performance but will open up a whole new world of possibilities to meet the needs of industry for a better today and tomorrow."



An example of the 'Polka Plate'.

Facts & Figures

Name:	Nippon Yakin Kogyo Co., Ltd.
Founded:	1925
Head office:	Tokyo, Japan
Overseas offices:	Chicago, USA; London, UK; Shanghai, China; Bangkok, Thailand
Employees:	1,072
Products:	Plates, Sheets, Coils
Materials:	Stainless Steels, Nickel Alloys
Website:	www.nyk.co.jp/en

Renewable jet fuel passes test

Virent Energy Systems has developed a plant-based jet fuel that has passed a round of U.S. Air Force testing. Produced in conjunction with Virent's partner, Shell, the fuel was tested at the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio. The test is part of efforts by Virent and its competitors to produce renewable fuels for military aircraft, to help fulfill the Pentagon's goal to rely less on petroleum. The Air Force flew a test flight this year with an F-22 Raptor, using a 50-50 blend of petroleum jet fuel and a biofuel derived from camelina, a weedlike oilseed plant not used for food. In contrast, Virent's renewable jet fuel would be a 100% renewable fuel as opposed



to a product that would be blended with petroleum. Virent's announcement came just weeks after Gevo Inc. of Englewood, Colorado, was awarded the biofuel industry's first contract to supply jet fuel to the Air

Force. The USD 600,000 contract consists of the supply of 11,000 gallons of alcohol-based jet fuel, which will be used for engine testing and a flight test demonstration using an A-10 aircraft.

Canada approves B.C. LNG shipments to Asia

Canadian regulators have approved a project to export liquefied natural gas from British Columbia's west coast to markets in Asia. KM LNG, a JV between Apache Corp. (APA), Encana Inc. (ECA) and EOG Resources Inc. (EOG), received the license from Canada's National Energy Board to export from a deepwater port in Kitimat, B.C. Initially estimated to cost CAD 5.6 billion, the license is a step forward for the project which is still undergoing a feasibility study by the partners. If the decision is made to build it, the terminal could start shipping natural gas to markets in Asia by late 2015, gradually shipping up to 1.4 billion cu/ft of natural gas a day. This is the first license Canadian regulators have issued to export LNG. KM LNG President Janine McArdle, who is also an Apache senior vice president had

this to say: "Kitimat LNG represents a remarkable opportunity to open up Asia Pacific markets to Canadian natural gas. This export license approval is another major milestone for Kitimat LNG as we move forward to market our LNG supply." The KM LNG project received a 20-year license from the Canadian government to export over 9 trillion cu/ft of gas over the life of the project. Nearby gas basins in British Columbia and Alberta owned by Apache and EOG contain over 19 trillion cu/ft of recoverable gas, according to documents filed with regulators. The three companies are expected to make a decision on whether to proceed with construction in the first quarter of next year. Apache leads the project and owns a 40% stake in the joint venture; Encana and EOG each own 30% stakes.

Chesapeake to anchor Enterprise's pipeline

Enterprise Products Partners L.P. (EPD) and Chesapeake Energy Corporation have entered into a long-term contract whereby Chesapeake will anchor Enterprise's proposed long-haul ethane pipeline from the Marcellus and Utica shale regions in Pennsylvania, West Virginia and Ohio to the U.S. Gulf Coast. The approximately 1230mi pipeline will have an initial capacity of 125,000 barrels per day of ethane

and could easily be expanded through a combination of additional pumping horsepower and pipeline looping. The committed shipper transportation rate will range between 14.5 cents per gallon and 15.5 cents per gallon. Through connections at the partnership's natural gas liquids (NGL) storage complex in Mont Belvieu, Texas, ethane production from the Marcellus and Utica shales would ultimately have direct

or indirect access to every ethylene plant in the U.S. The pipeline could begin commercial operations by the first quarter of 2014. This new pipeline would provide producers in the Marcellus Shale play, as well as the Utica Shale, with much-needed midstream infrastructure to facilitate production of NGL-rich natural gas. It will also provide shippers with access to the highest value markets on the U.S. Gulf Coast for their ethane.

SAP plants planned for Brazil, China

BASF is strengthening its position in the superabsorbent polymers (SAP) market with investments in local production sites in fast growing emerging markets. In South America, BASF will build a SAP plant in Camacari, Brazil with an annual capacity of 60,000 metric tons. Production is ex-

pected to start in late 2014. In China, BASF-YPC Co. Ltd, a 50-50 joint venture between BASF and Sinopec, plans to start construction of a 60,000-metric-ton SAP plant at its Verbund site in Nanjing in mid 2012. Commercial production is planned for the beginning of 2014.