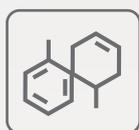


NH1949

New anti-coking material



Innovative new materials



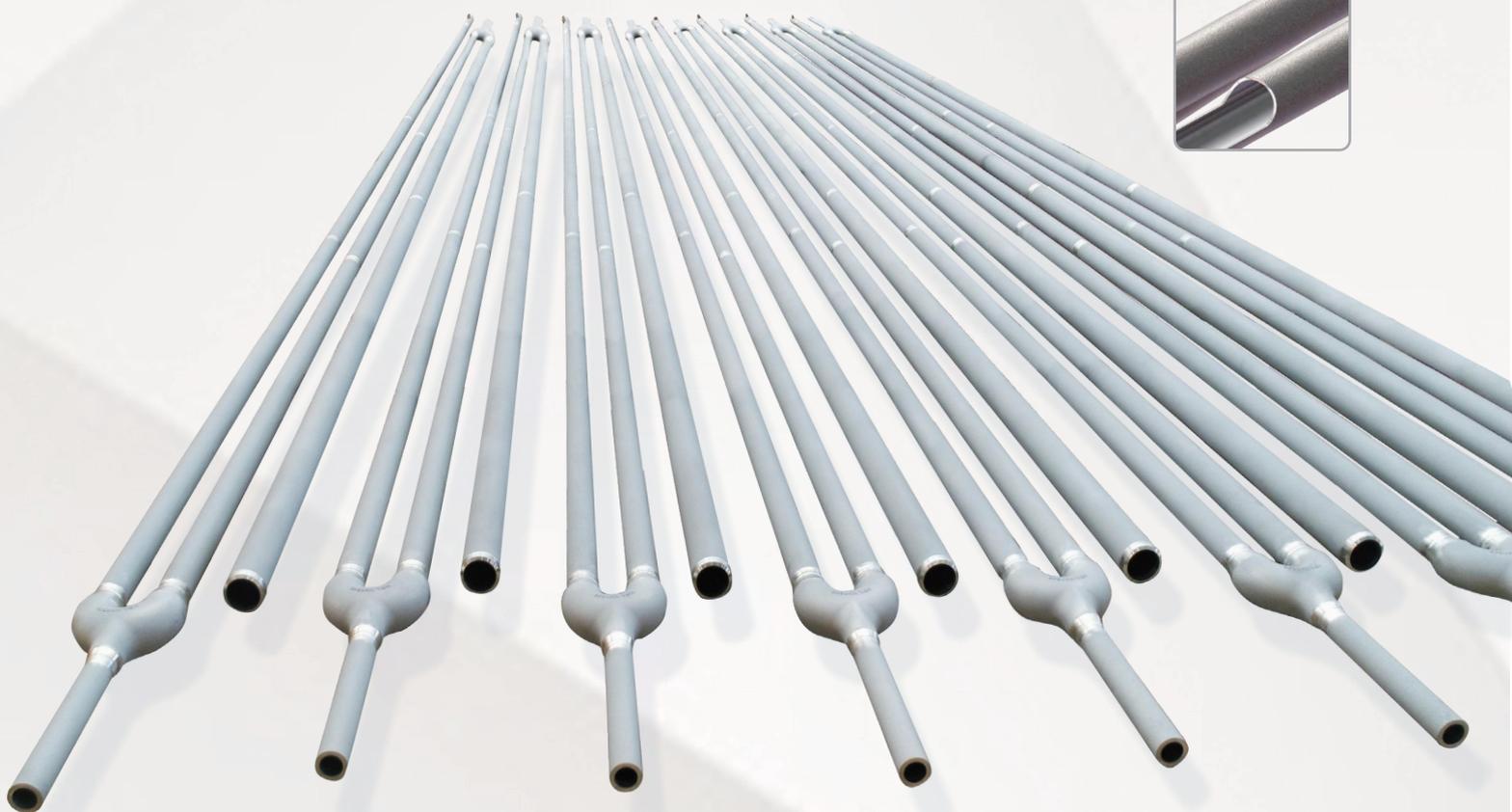
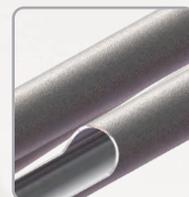
Extending the run length



Extends furnace tube life



Cost reduction and efficiency gains



Overview of Qingdao NPA



Qingdao NPA Industry Co., Ltd. is a subsidiary of Gaona Aero Material Co., Ltd. NPA mainly produces heat-resistant alloy products with an operating temperature range of 900-1250°C provides integrated solutions of heat-resistant alloy for industrial furnaces around the world, and mainly serves the petrochemical, metallurgy and glass industries to provide ethylene cracking furnace tube and reformer furnace tube, metallurgical production line of various types of furnace, radiation tube, combustion system and environmental protection hazardous waste treatment multi-bed furnace equipment and other products and integration service.

Product Description

Since 2012, we have independently developed a new generation of high-temperature alloy ethylene cracking furnace tube, which generates stable Al_2O_3 oxide film by adding Al element, so that the alloy has excellent oxidation resistance, carburizing resistance and coking resistance.

Additions of tungsten and rare earth elements provide solution strengthening and grain boundary purification, to ensure that it still has excellent high temperature mechanical properties above 1100°C . NH1949 alloy furnace tubes and static castings are of the highest metallurgical quality providing excellent service performance. Controlled manufacturing and processing ensures that NH1949 alloy products have excellent mechanical properties and catalytic coking resistance. This can significantly extend the run length of ethylene cracking furnaces, minimal carburisation, improved production efficiency and extended service life.



NH1949 Advantages

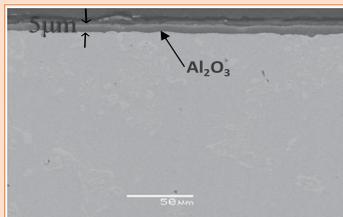
The Fe and Ni in the tube have a strong catalytic effect on coking. In the early stage of coking, longitudinal filamentary coke is formed on the inner wall of the furnace tube. Filamentous coke will reduce the surface quality of the tube and promote gas phase coking and free radical coking.

In order to effectively isolate the Fe and Ni in the furnace tube from the cracking raw materials and reduce catalytic coking, the usual method is to form an oxide layer on the surface of the furnace tube material, the oxide layer of the traditional material is a chromium oxide layer, and the oxide layer of the new aluminum material NH1949 is an aluminum oxide layer. Compared with the chromium oxide layer of the traditional material, the alumina layer of the new aluminum material NH1949 has the following advantages.

NH1949 New material



Traditional material



☑ Good thermal stability

It does not produce volatile components with the increase of temperature, and the structure is stable at 1200°C

☑ Automatic repair

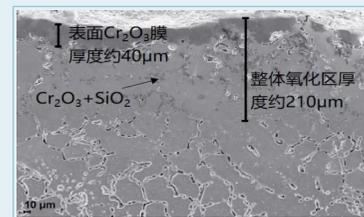
During service, the oxide film can be automatically repaired and permanently protected

☑ Not easy to break

Fine grain, thin oxide layer thickness, not easy to break, flake or peel.

☑ Long coke cleaning period

Run length between coke cleaning period can be extended more than 2-4 times



• Instability

Unstable above 980°C , volatile, porous and cracking

• Unsound

Internal oxidation, the protection of furnace tube is limited

• Easy to break

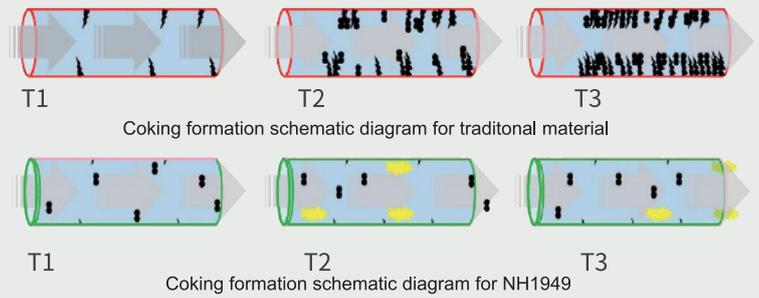
The oxide layer is thick and easy to break and flake off or spall

• Run time between decoke

Run time between decoke cleaning cycle 30-60 days

Coking process of traditional materials and new aluminum materials NH1949

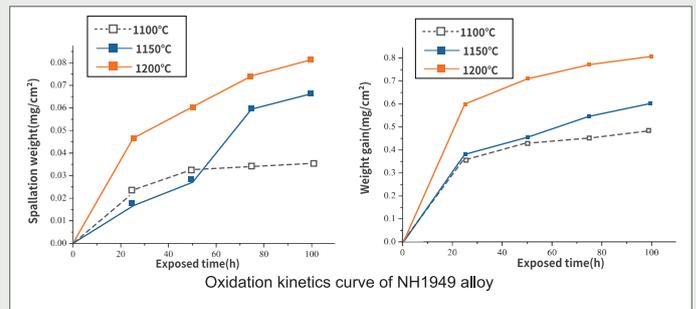
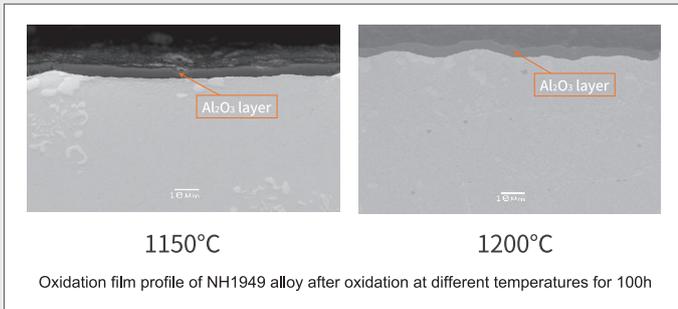
- The NH1949 provides customers with **increased capacity** (longer run length, higher conversion rate, lower S/HC ratio)
- **Energy saving:** Reduced coking frequency, lower TMT, lower CO₂ emissions;
- The **operation efficiency of cracking furnace is higher;**



NH1949 Basic Performance

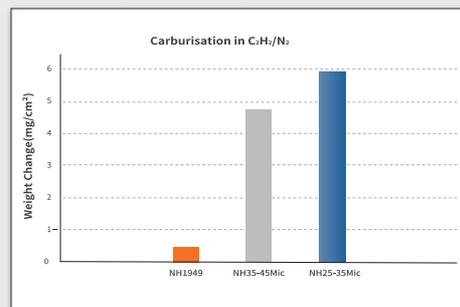
Antioxidation property

NH1949 alloy oxidation weight gain rate is low and the amount of spalling is low. The Al₂O₃ film is stable up to 1200°C and the surface coverage can still be continuous at more than 95%. The oxide film distribution is uniform and continuous with a dense structure and the matrix interface is tight ensuring that the alloy has excellent carburizing and coking resistance below 1200°C .



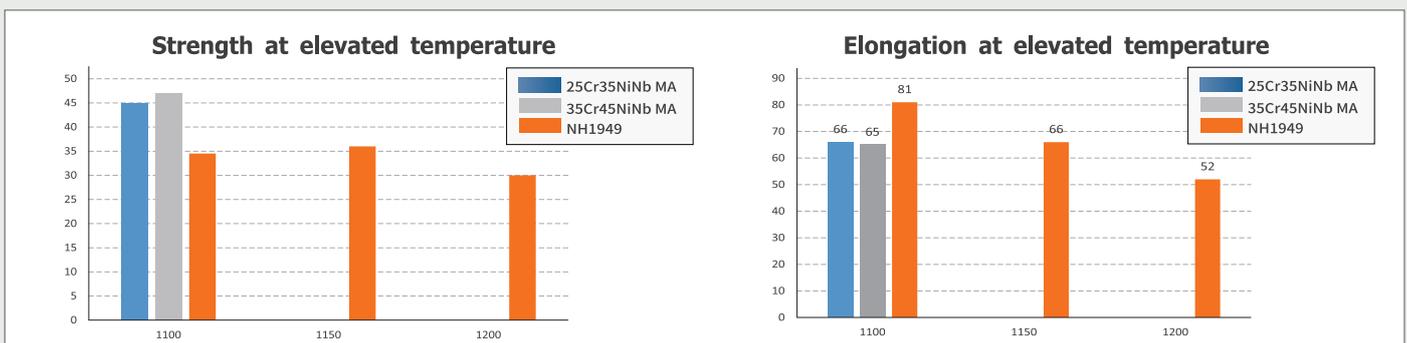
Resistance to carburisation

NH1949 alloy has excellent carburizing properties, in the mixed atmosphere of C₂H₂/H₂ at 1100°C for 8 hours of carburizing, the carburizing weight of NH1949 alloy is only 1/10 of the traditional material NH25-35Mic or NH35-45Mic alloy.



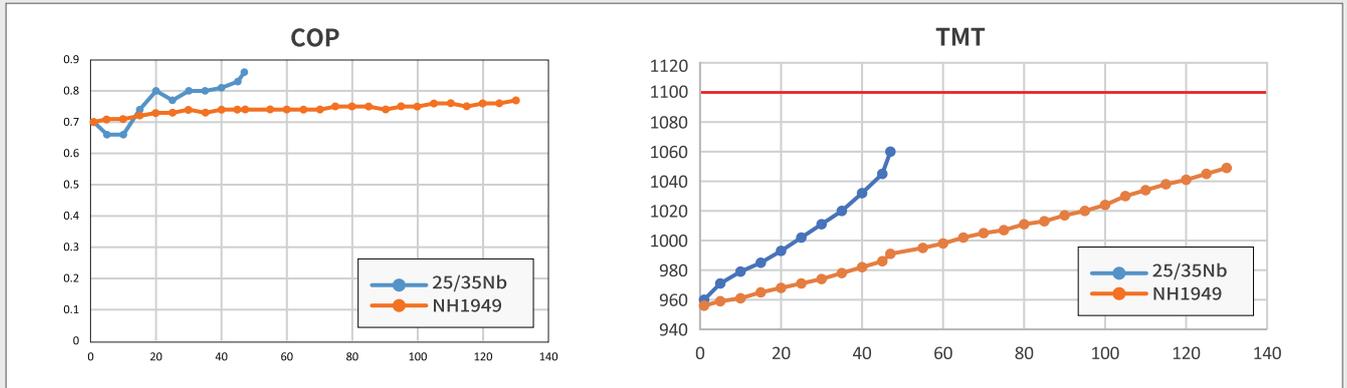
High temperature strength

Since the tensile strength at 1150°C for NH1949 is equivalent to that of 25Cr35NiNb MA and 35Cr45NiNb MA at 1100°C, the application temperature of NH1949 can be 50°C higher than that of traditional materials.



Application Case

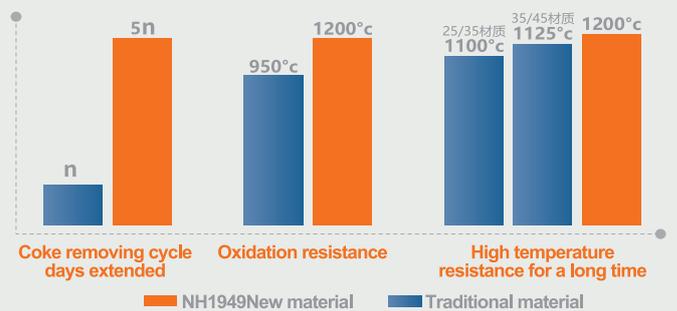
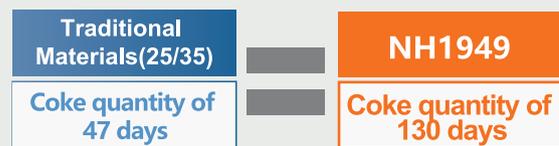
NH1949 was installed in the gas cracking furnace for the first time in November 2020, and the changes of TMT and absolute pressure ratio are shown in the figure below.



NH1949 operating for 130 days has a TMT of 1049°C and an absolute pressure ratio of **0.77**. The cracking furnace can continue to operate with no need to stop for de-coking; whilst the traditional material has been running for 47 days, the TMT of the furnace tube has reached 1060°C, and the absolute pressure ratio has reached **0.88**, at which time the furnace needs to be stopped for de-coking. The amount of coke produced by NH1949 after **130** days of operation is comparable to that produced by traditional materials after **47** days of operation.

NH1949's outstanding performance in the following areas has been certified for industrial furnace use.

- **Anti-coking:** extend the coking period by 2-5 times, reduce the amount of coke
- **Anti-oxidation:** Complete oxidation resistance at 1200°C reduces the damage to the outer wall of the furnace tube, maintains the effective bearing area, and extends the life of the furnace tube service to 1.5-2 times
- **Long-term service:** 1150°C long-term service can optimize cracking parameters, increase COT temperature 7-15°C, increase ethylene yield 2-3%

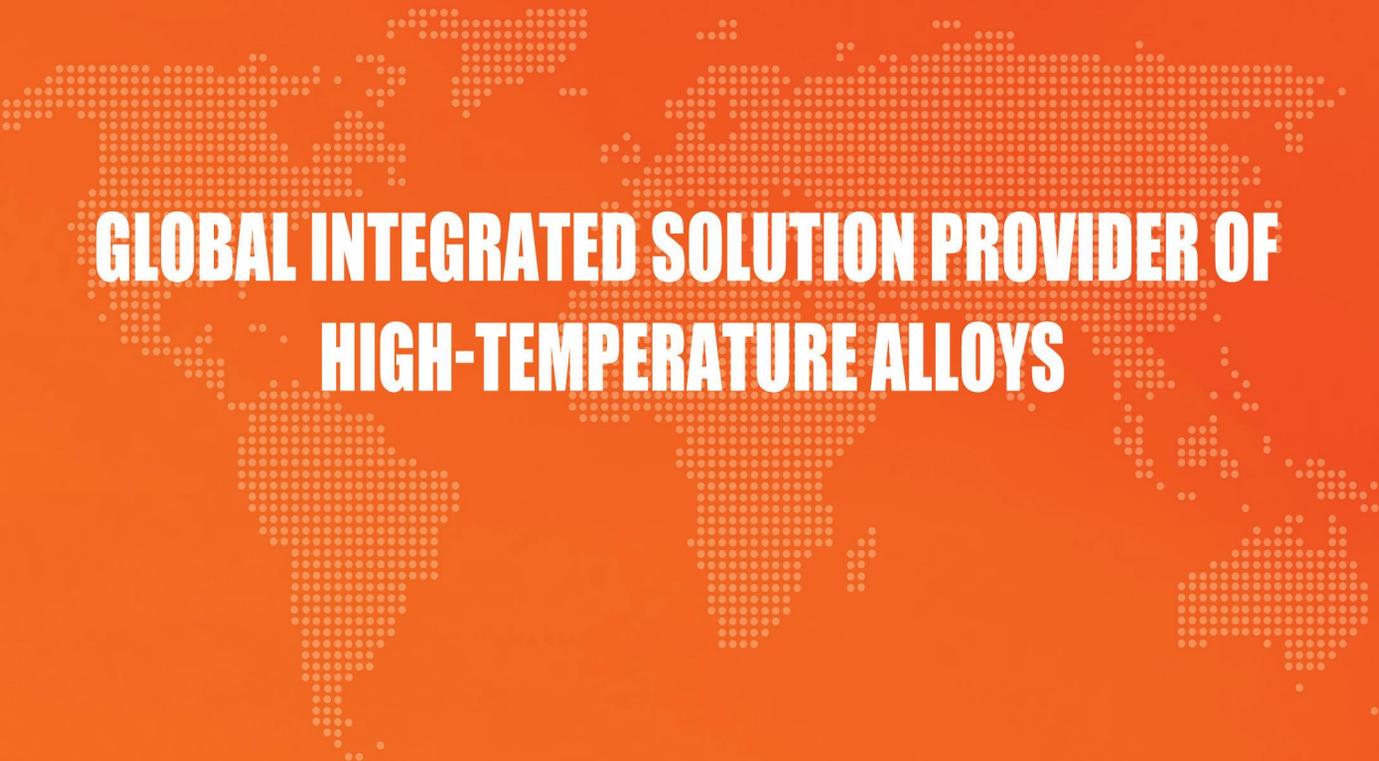


NH1949 Application and IP Layout

NH1949 was first used in a 150,000ton/year cracking furnace since 2020, the fact that 21 furnaces were equipped with NH1949 technology to the end of 2024. There are domestic customers, and customers from the United States, Russia, the Middle East and so on. Furnace types include Linde, SW, Lummues and CBL.

The company has completed the layout of intellectual property rights in 42 countries around the world, and has obtained the invention patent authorization from China, the European Union, Japan, Russia, Saudi Arabia, South Africa, South Korea, Singapore, Canada, India, Brazil, Ukraine, and other countries have completed the first and second trials.





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