

Solutions

Bringing together “strong individuality” for rapid growth of the aircraft business

The Hitachi Metals Group’s Medium-Term Management Plan designates aircraft/energy-related materials business as an area of high growth, and we are proactively making large investments in this business. This has included the 840-ton ring mill at the Okegawa Works, which commenced operations in November 2015, where we have pursued innovative technologies from certification to mass production of aircraft engine materials. This has resulted in orders for and mass production of combustor case materials for aircraft engines. In the spirit of *wa sureba tsuyoshi*, solutions that bring together strong individual elements are leading to major breakthroughs.



Solutions

Solution Case Study

Beginning development for aircraft engine-use combustor case materials

The Specialty Steel Company’s Okegawa Works installed and started operating an 840-ton ring mill, with pressure capability that ranks among the world’s largest, in November 2015 to expand our business in the aircraft/energy-related market, which is earmarked as a future growth driver. This has made it possible to manufacture combustor case materials for medium-sized to large engines.

Hitachi Metals America, Ltd. (HMA) is our contact point in North America for a major aircraft engine manufacturer. In addition to the record of accomplishment in manufacturing many types of aircraft/energy-related materials established at the Okegawa and Yasugi works, HMA proactively presented our robust equipment capabilities. Interest shown by the major U.S. aircraft engine manufacturer led to our decision to develop aircraft engine-use combustor case materials.

Bringing together technological capabilities and sales capabilities for undisputed “strong individuality”

Passenger jet aircraft are entrusted with the lives of many people and require an exacting degree of safety, and international systems operate independently for the certification of strict quality management systems and special process operations for aircraft parts. Therefore, in addition to advanced technological capabilities, materials manufacturers require production structures and certifications that meet strict quality requirements.

The rolling of aircraft engine materials encompasses a great challenge from the unique degree of difficulty in processing the nickel alloy used for mass production. The Okegawa Works is applying its expertise from a 350-ton ring mill, which was



(From left) Hiroki Yanase and Jun Osone of the Specialty Steel Company’s Okegawa Works, Shiyoji Samori of the Okegawa Works who cooperated with development, and Toshiyuki Mitsuji of the Aerospace & Energy Materials Business Unit



the main piece of equipment used, to acquire expertise in the use of an 840-ton ring mill, and working with engineers at the Yasugi Works was able to achieve required settings for metal forming and heat treatment processes. This enabled the development of aircraft engine-use combustor case materials in 2016, and the mass production of combustor case materials for new types of engines that will be used in next-generation passenger jet aircraft.

The Hitachi Metals Group was able to succeed with this project by using the Okegawa Works’ superior manufacturing technology combined with the expertise and sales capabilities of the Aerospace & Energy Materials Business Unit, and through cooperation with HMA, which has connections with the major aircraft engine manufacturer. This embodies the spirit of our *wa sureba tsuyoshi* (“strength through harmony”) Corporate Philosophy by bringing together the “strong individuality” represented by the enthusiasm of all involved, including technological expertise and sales.

Technological breakthroughs in orders and mass production

Processing of the material WASPALOY®*1 was the key to orders and mass production of aircraft engine-use combustor case materials. WASPALOY® is a nickel-based alloy that has good strength at high temperatures and excellent high-temperature corrosion and sulfidation resistance. The other main ultra heat-resistant nickel-based alloy is Alloy 718*2. WASPALOY®

has a superior strength than Alloy 718 at high temperatures, but is also more difficult to form. Following a series of highly detailed studies to derive the optimal operation conditions, the Okegawa Works acquired technological expertise and created proprietary forming technologies of WASPALOY®. This was an important technological breakthrough.

Currently, the Okegawa Works is the only facility in Japan that is able to mass produce combustor case materials for medium-sized and large aircraft engines with WASPALOY®. We have already received inquiries from other aircraft engine manufacturers and started several new projects. Going forward, the Hitachi Metals Group will continue to strengthen its aircraft/energy-related materials business through combinations of “strong individuality.” We are aiming for sales

of more than ¥60 billion as one of the world’s top four companies in the area by fiscal 2025.

*1 Registered trademark of United Technologies Corporation. An ultra heat-resistant nickel-based alloy that is stronger than Alloy 718 in high-temperature ranges.

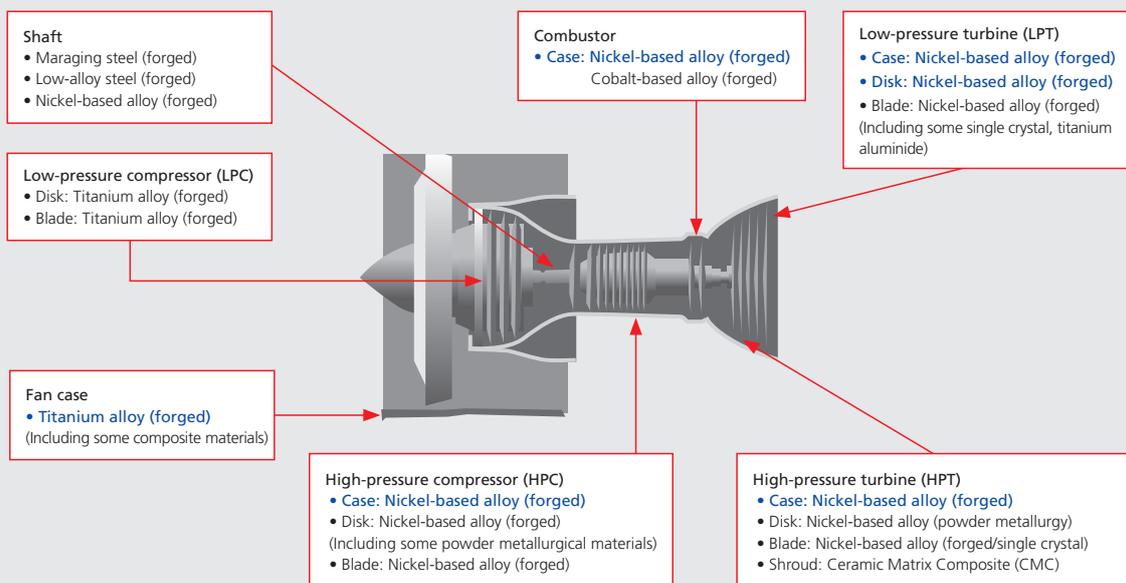
*2 An ultra heat-resistant nickel-based alloy with superior strength at high temperatures.



Special properties of nickel-based alloys and target products for aircraft engines

Jet aircraft engines use the energy from combustion gas to turn fans that propel the aircraft. Temperatures inside the engine can reach as high as 1,600 degrees Celsius, and enhancing heat resistance is the key to achieving efficiency. Therefore, nickel-based alloys, which are heat resistant and strong at high temperatures, are the main material used especially for the so-called hot section—the area within the engine through which pressurized, combusted air passes. The high heat resistance of nickel-based alloys is what makes them difficult to form, and limits the appropriate temperature range at which forming can be done. By bringing together our experience, knowledge, and technological expertise in ring mills, the Hitachi Metals Group has achieved optimization of production processes and operation conditions to satisfy our customers’ requirements. With the Hitachi Metals Group’s innovative nickel-based alloy processing technologies and 840-ton ring mill, we anticipate increased sales of a variety of products in addition to combustor cases.

Cross-section view of an aircraft engine and most-used materials



Note: Blue lettering indicates products for which increased sales are anticipated following installation of 840-ton ring mill.