New Products

Thick Plate of Aluminum Alloys for Aircraft

1. INTRODUCTION

Furukawa-Sky Aluminum is supplying aluminum rolled products of high quality to a broad range of industries. Especially in the field of thick plates for aircraft, the Company maintains the top market share taking advantage of the nation's foremost thick plate production facilities at its Fukui Works.

The Fukui Works acquired the certification of AS9100 in April 2005 for the first time in the domestic light metal rolled products industry, and we were also registered in the internationally unified database system OASIS (Online Aerospace Supplier Information System) of IAQG (International Aerospace Quality Group). AS9100 is formulated as an internationally viable standard, and stands for American Aerospace Quality Group of IAQG9100, the internationally unified standard of IAQG's quality management system. Compared to the ISO9001 international standard for quality management, it involves additional requirements specific to aerospace industry such as functions, performance, and reliability and safety guarantees of aerospace products. This certification acquisition has brought about an international recognition of our Company as a manufacturer of aluminum thick plates for aircraft, so that more foreign aircraft manufacturers have begun to use our thick plates for aircraft in their airframes.

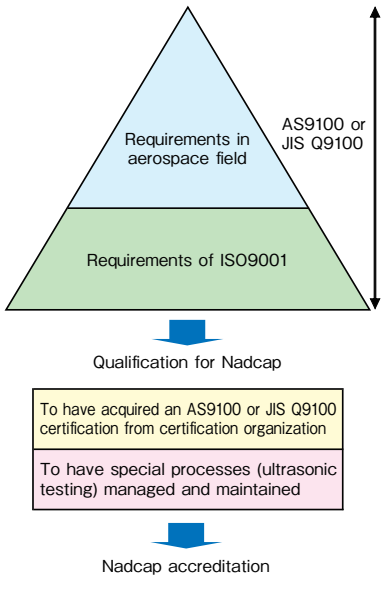

Figure 1 Correlation between AS9100 and Nadcap.

Manufacturing of airframes for aircraft involves: 1) certification of quality management system, 2) accreditation of materials by airframe manufacturer, and 3) accreditation of special processes including heat treatment in material manufacturing and nondestructive testing for quality assurance. Especially for special processes, as shown in Figure 1, it is indispensable to have accreditation from an international accreditation organization Nadcap (National Aerospace and Defense Contractors Accreditation Program), and accordingly, the Fukui Works acquired the certification in August 2006. Also, our Oyama Forging Plant has already acquired the certification.

Now that Furukawa-Sky Aluminum is the only manufacturer of aluminum rolled products in this country that has acquired Nadcap accreditation, the observance of the manufacturing conditions in the special processes will be accredited together with control levels by periodical surveys even after the accreditation acquisition. Table 1 shows the main accreditation status at the Fukui Works.

2. DEVELOPMENT BACKGROUND

Demands for thick plates for aircraft increased centering on commercial aircraft in the late 1990s, and the Fukui Works carried out numerous developments to cope with such growing demands. Against this background, the demand for 7000-series materials --- specifically 7050-alloy materials that have high strength and high toughness --- grew rapidly, as the component structures changed from assembly-type to integrally machined-type with the objective of airframe lightening and man-hour reduction.

The Fukui Works has been developing technologies aimed at an integrated system of production from casting to rolling for 7050-alloy materials. Since this alloy is prone to crack during ingot cooling, we have accumulated vari-

Table 1 Accreditation status at the Fukui Works.

Alloy / Process	Applicable standard
2024	AMS-QQ-A-250/4
2024C	AMS-QQ-A-250/5
7050	AMS4050
7075	AMS-QQ-A-250/12
7475	AMS4202
Heat treatment	AMS2750
	AMS2772
Ultrasonic testing	AMS-STD-2154
	Nadcap

ous improvements in terms of ingot form and the application method of cooling water during casting, and ultimately achieved delivery of the mass products to domestic airframe manufacturers in 2002. In 2004, we acquired an accreditation of Canadian airframe manufacturer Bombardier Aerospace to begin delivery.

3. FEATURES

3.1 Materials

Aircraft is required to reduce its weight to ensure flight performance and fuel cost reduction, and this leads to the use of the 2000-series and 7000-series aluminum alloys the strength of which can be improved through heat treatment. For example, for the outer airframe panels, 2024C-alloy plate is used comprising 2024-alloy clad with a 1000-series alloy on the surface, and for portions constituting the airframe, 7050- and 7475-alloys are mainly used. Among these, 2024C-alloy plate is used, after surface polished to give mirror finish, as an outer panel for commercial passenger aircraft, while 7050- and 7475-alloys are used in a variety of fields including airframes for the Ministry of Defense. In the aerospace industry, 2000-series alloys are used as a liquid fuel tank stock for the H2A rockets.

These alloys are manufactured using heat treatment to satisfy the required strength and other properties.

3.2 Quality Requirements

It is required, to cope with further safety design, that these materials have enhanced properties in fracture mechanics such as stress corrosion resistance and fracture toughness as well as high strength. To this end, all the processes are managed to manufacture high-quality products, including thorough control of temperature and filtering capability in the casting process in addition to periodic checkup of temperature control functions in the heat treatment process. And the products produced by these strictly controlled processes undergo a series of shipping tests such as strength test, electric conductivity test and K1c test, in order to guarantee their quality.

3.3 Features in Manufacturing

Unlike aluminum alloys for general purpose, the heat treatment alloys for aircraft mentioned above require numerous processes such as solution treatment and quenching, residual stress relief, and aging treatment. Two quenching furnaces have been installed in the Fukui Works, so that it is possible to solution treat and quench thick plates having a thickness of 127 mm maximum and a width of 3,000 mm maximum. The No.2 quenching furnace shown in Figure 2 is a new and powerful machine that went into operation in January 2006. In addition to a hot roughing-down mill that is the world's second largest in terms of the maximum rolling width, we have a stretcher having the largest power in the country, thereby making it possible to manufacture the nation's largest aluminum thick plates for aircraft. Moreover, an ultrasonic tester is used to assure that the thick plate products are free from internal defects such as porosity attributable to casting structures.

All these processes are the subjects of the Nadcap accreditation mentioned above, and day-by-day management is strictly exercised.

4. PRODUCTS SIZE

It is required these days that materials for aircraft be thicker and stronger. Table 2 shows the size of typical products with the maximum thickness manufacturable.

5. CONCLUSION

The demand for 7050-alloy with improved property is increasing as thick plates for new aircraft that is scheduled to be in operation soon. In response to the requirements of airframe components manufacturers, we are further promoting research and development in order to supply better materials with higher strength and higher toughness.

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Figure 2 No.2 quenching furnace.

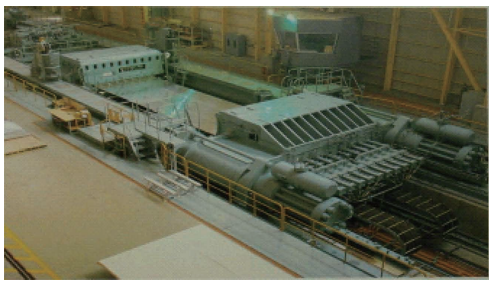

Figure 3 Stretcher.

Table 2 Size of typical products with the maximum thickness manufacturable.

Alloy / temper	Typical size (mm)
2024C-T3	5 × 2390 × 12000
7050-T7451	127 × 1219 × 3658
7475-T7351	102 × 1219 × 3658