S S F E H -T S O R JFE20-5HS

MIZUTANI Akito[*1] FUKUDA Kunio[*2] FUJISAWA Mitsuyuki[*3]

Abstract:

Al-containing stainless steel foil JFE20-5HS , hich has 1.5 times higher high-temperature strength than that of conventional steel and e cellent o idation resistance, has been developed. There ere t o problems in increasing the high-temperature strength of the conventional steel: 1) to prevent deterioration of o idation resistance, and 2) to ensure suf cient toughness of hot-rolled sheet for stable cold rolling. In order to solve these problems, the effect of the solid solution strengthening element on the o idation resistance of the high-Al steel as investigated, and Mo as found as the element ith little deterioration of the o idation resistance. Furthermore, by clarifying the relationship bet een the amount of Mo addition and the toughness of the hot rolled sheet, the optimum amount of Mo addition as determined. By applying this product to metal honeycomb of automobiles, it is e pected to improve heat resistance property of catalytic converters.

1. I d c

Automobiles are equipped with a catalytic converter to detoxify harmful components contained in exhaust gas. Catalytic converters have a structure in which a catalyst carrier with a honeycomb structure is inserted inside a shell made from a stainless steel sheet. The materials used as catalyst carriers are ceramic carriers or stainless steel foil. **F e 1**[1)] metal honeycombs, which possess higher vibration resistance than ceramics, are the main type used in motorcycles, as the catalytic converter is more easily subjected to impact and vibration than in four-wheeled automobiles for structural reasons[2–5].

In some cases, the interior of a catalytic converter can reach a high temperature exceeding 1 000˚C due to the heat generated by the reaction between the catalyst

the foil material with the thickness of 50 μm, and corrugation processing of one of the sample sheets was performed by passing the sample between two gears. The corrugated foil and flat foil were then stacked and wound, after which the end part was welded. The test pieces for evaluation in the oxidation test were prepared by performing heat treatment by holding the samples in a vacuum at 1 150˚C for 30 min to simulate the brazing process. The oxidation test was carried out at 1 100˚C in atmospheric air. During the test, the test pieces were removed from the furnace at holding intervals of 5 to 50 h, and the weight change and the length change were measured.

2.1.2 Re a d d c

The effects of the various added elements on the high-temperature strength of the 20Cr-5Al steel are shown in **F . 5**. The high-temperature strength of the 20Cr-5Al steel increased when each of the solid solution strengthening elements was added. Comparing the increase in high-temperature strength per amount of addition, the highest unit increase was 74% with addition of 0.35% Nb. The next highest increase after Nb was obtained by addition of Mo, and the increase in high-temperature strength decreased with Ta and W, in that order. The increases obtained with addition of approximately 5% Mo, Ta and W were 82%, 69% and 48%.

Next, the oxidation resistance of the steels with these added elements was evaluated. **F e 6** shows the effect of the added elements on the increase in oxidation amount (measured as weight change) and the length change of the 20Cr-5Al steel after holding at 1 100˚C for 400 h in the air. In this oxidation test, spalling of the Al_2O_3 scale did not occur in any of the steels. Comparing the amount of oxidation, weight change increased with the addition of each of the solid solu-

sheet toughness that enables stable foil rolling, the optimum amount of Mo addition was studied. A separate investigation of the relationship between the DBTT of the hot-rolled sheet and the strip breakage rate during cold rolling revealed that the breakage rate decreases greatly and stable cold rolling is possible if DBTT is 140˚C or less. On the other hand, from the results shown in Fig. 8, it can be understood that DBTT decreases to less than 140˚C when the Mo content is no more than 3%. Based on these study results, the Mo content of the developed steel was set at 3%.

3. C a ac e c JFE20-5HS

The composition of the developed steel was decided based on the composition design guidelines described up to this point. **Tab e 2** shows the chemical composition of the conventional steel, JFE20-5USR, and the developed steel, JFE20-5HS. In comparison with the conventional steel, the high-temperature strength of the developed steel was increased by 3% addition of Mo. In the following, the high-temperature strength and high-temperature oxidation resistance of the developed steel are shown by comparison with the conventional steel.

3.1 H -Te[redacted]

conventional steel. The shape change (length change) of the developed steel after the oxidation test was also