KAWASAKI STEEL TECHNICAL REPORT
No.40 (May 1999)
Steinless Steel and Steel Platel

Weldability of Advanced Extremel y-low Carbon Bainitic Steel for Thick Plates of 570 MPa Grade through As-Rolled Process

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Synopsis :

An extremely-low carbon bainitic steel with about 0.02 mass% or less carbon content can be applied to the manufacture of high st rength heavy gauge steel plates because of the unique features such as a granular baini tic ferrite microstructure independent of cooling rate after plate rolling. Being free from martensite transformation due to the decrease in carbon minimizes the hardening of heat-affected zone (HAZ) and the deterioration of HAZ toughness at an increase in the welding heat input. A design to control the microstrucure for extremely-low

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be obtained. This chapter describes the transformation behavior of such extremely-low carbon steel modified to

Photo 1 shows optical microscopic pictures of typical microstructures. The Bainitic structure of extremely-low

2.2 Hardenability

steel which shows only a little change in microstructure,

Table 2 Chemical compositions of extremely low-carbon bainitic [illegible]

(mass%)

C	Si	Mn	P	S	Al	Ti	N	Others	Ceq	Pcm
0.012	0.30	1.56	0.009	0.003	0.029	0.011	0.0028	Cu, Ni, Nb, B	0.294	0.137

Ceq = C + Mn/6 + Si/24 + Ni/40 + Cr/5 + Mo/4 + V/14

Pcm = C + Si/30 + Mn/20 + Cu/20 + Ni/60 + Cr/20 + Mo/15 + V/10 + 5B

Table 3 Tensile test results of steel plates

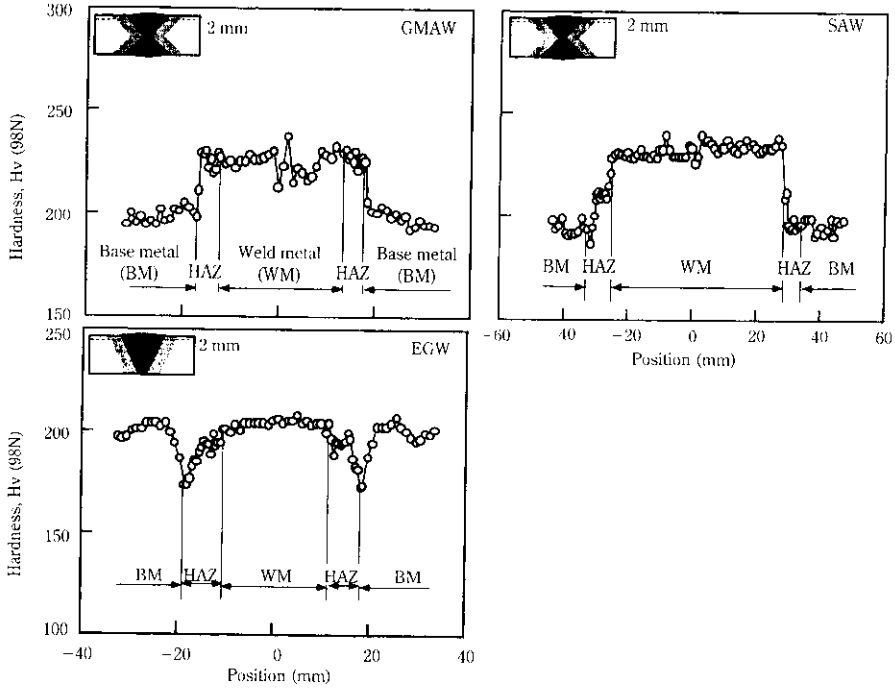

Fig. 7 Hardness destributions of welded joints

Table 5 Welding conditions for evaluation of weld performance of extremely-low carbon

Table 7 V-notch Charpy impact test results of welded joints

4 Conclusion

A new type of non-heat treated thick high strength steel plates of TS570 MPa grade has been developed. By reducing the carbon content to about 0.02 mass% or less and by doping alloy elements, the microstructure of this steel is made mostly of granular bainitic ferrite for a wide range of cooling rates. As a result of evaluating the

By developing this new steel, it has become possible to quickly supply 570 MPa grade thick high strength steel plates up to 75 mm thick in as-rolled conditions. This steel has made welding process entirely free from preheating and can be welded with a large heat input of up to 20 kJ/mm. At present, application of this steel to bridges has begun and extension of application to the civil and architecture fields is scheduled.