TOP PLATE

TOKUDEN

特殊電極株式会社

TOKUDEN TOP PLATE

TOP PLATE is a special clad steel plate manufactured by depositing, by means of overlay welding, ultra abrasion resisting alloy on the base metal usually made of mild steel plate. Our special automatic welding method has made it possible to manufacture very hard and high-quality plates which are practically free from cracks and strains.

Features

The chief advantage of TOP PLATE is its excellent abrasion resistance. Especially, precipitation of various kinds of carbide has made it possible to be used for the parts which require strong abrasion wear and erosion wear.
Furthermore, the standard thickness of base material is 9 mm(or 6 mm), making the plate light enough for one person to carry easily.
The surface of TOP PLATE is smooth without any practical irregularity.
Cracks and strains are eliminated to the inconceivable degree the conventional materials could not attain.

Chemical Composition

Four types of TOP PLATEs are currently available. All of them mainly consists of high Cr cast iron. This makes it possible for plate to precipitate a large amount of Cr carbide with high hardness (HV>1300), showing a good abrasion resistance. The higher grade plates which are made to precipitate composite carbide in addition to Cr carbide have made it possible to realize more hardness and stronger abrasion resistance.

Types of Plates

The follow four types of TOP PLATEs are currently available.

Description	Chemical composition	Hardness(HS)
TOP Gr-A	High Cr cast iron	70 ～ (80)
TOP Gr-B	High Cr cast iron+ composite carbide	75 ～ (85)
TOP Gr-C	High Cr cast iron+ composite carbide	80 ～ (90)
TOP Gr-E	High Cr cast iron+ composite carbide	80 ～ (90)

Shape

TOP PLATEs with the following ten kinds of standard sizes are available. Plates with a larger size than the ones as shown below can also be produced. Various shapes of plates and fabricated vessels can also be produced.

■ **Shape of standard-type TOP PLATE**

Width of plate (mm)	Length of plate (mm)	Thickness of base metal (mm)	Thickness of deposited metal (mm)	Total thickness of plate(mm)
100	1000	6 or 9	6	12 or 15
150	1000	6 or 9	6	12 or 15
200	1000	6 or 9	6	12 or 15
250	1000	6 or 9	6	12 or 15
300	1000	6 or 9	6	12 or 15

* The maximum size of TOP PLATE that can be made of one sheet of plate:
When base material with the thickness of 6 mm (plate with the total thickness of 12 mm) is used: 750×1,500 (mm)
When base material with the thickness of 9 mm (plate with the total thickness of 15 mm) is used: 1,000×2,000 (mm)

Application

Our TOP PLATEs can be applied to various industrial fields such as cement, iron manufacturing, coke, coal, mining, ceramics, civil engineering and quarrying, casting, etc.
Equipment to which TOP PLATE is applied: Various kinds of chutes, hoppers, fans, various kinds of liners, screens, crushers, various kinds of guides, grizzly bars, dampers, mixers, cyclones, etc.

External View

The following photo shows external views of TOP PLATEs.
The surface looks very beautiful without any cracks.

Photo: External views of TOP PLATEs

Macrostructure of Cross Section

The following photo shows the macrostructures of cross sections of TOP PLATEs.
The cross sections look good with no cracks. They have beautiful edges which extend as far as the end of base metal.

Photo
Macrostructures of cross sections of TOP PLATEs

Microstructure

The following photos show examples of microstructures of TOP PLATE Gr-A, Gr-B, Gr-C and Gr-E. The amount of precipitated chrome carbide and composite carbide increases as the grade of PLATE goes up.

Photo: TOP Gr-A
Microstructure
× 100

Photo: TOP Gr-B
Microstructure
× 100

Photo: TOP Gr-C
Microstructure
× 100

Photo: TOP Gr-E
Microstructure
× 100

Abrasion Resistance

It is considered that TOP PLATE may be mainly abraded by grinding and erosion caused by slipping of materials which flow in room or high temperature.
The abrasion test performed by our company is RWAT (Rubber Wheel Abrasion Test). In this test, a test, specimen is pressed, under a proper load, against the circumference of rotating rubber wheel with powder (sand) supplied between them, and the degrees of abrasion caused by this powder are compared.
The out line of the test is illustrated below.
The test results of TOP PLATEs of Gr-A, Gr-B, Gr-C, and Gr-E are listed in the table below together with the results of reference tests performed for mild steel, carbon steel, stainless steel, various kinds of steel castings, tool steel, corumonoy weld metal, satellite weld metal and others.

■ Results of Abrasion Test

- Load: 8.8 kg
- Number of rotations: 3,000 and 6,000
- Rotation speed: 120 r.p.m.
- Disk diameter: 250 mm
- Powder: Quartz sand No.6
- Amount of sand supplied: 300 g/min.
- Dimensions of specimen: 20T ×20W×40L

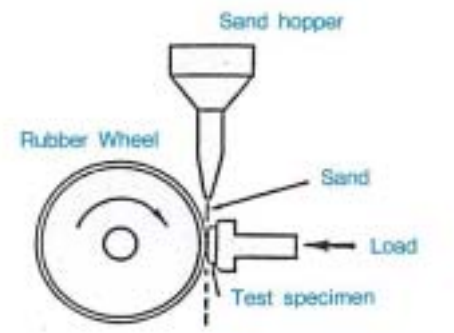

Fig. Outline of Test Mechanism

■ Test Conditions

	Loss in weight(g)		
	3,000 rotations	6,000 rotations	Abrasion resistance ratio
TOP Gr-A	0.1389	0.2367	10.97
TOP Gr-B	0.1185	0.2199	13.13
TOP Gr-C	0.0912	0.1626	17.75
TOP Gr-E	0.0616	0.1183	24.40
Cr cast iron (3C-20Cr-3Mo)	0.1454	0.2975	9.70
Ni-hard 4 (Ni alloy castings)	0.2294	0.3954	7.30
Cr-Mo-Ni cast steel (0.3C-1Cr)	1.2516	2.2334	1.29
13Mn cast steel (1C-13Mn)	1.1829	2.2008	1.31
SK-3 (Hardening) (1.1C)	0.9462	1.7631	1.64
Corumonoy No.6 (Si-Cr-B-Ni)	0.3703	0.7106	4.06
Stellite No.1 (Co-Cr-W)	0.4838	0.9451	3.05
Stellite No.6 (Co-Cr-W)	0.5736	1.0684	2.70
Stainless steel (SUS316)	1.4234	2.7503	1.05
Gray iron castings (FC250)	1.2766	2.3689	1.22
Carbon steel (S35C)	1.3088	2.4530	1.18
Mild steel (SS400)	1.5008	2.8862	1.00

*The above abrasion resistance ratios are obtained with that of mild steel regarded as 1.0.

Macrostruc-ture of Cross Section

TOP PLATE is applied to equipment after various processings as shown below have been made. The following pictures show various cases where TOP PLATE has been applied to equipment.

Various types of plates bent inside (base metal outside)

Pipe

Mill liner

Pipe

Back pressure equalizer

Bulldozer edge

Miter bend