New Products & Technologies

Extra-length Colored Stainless Steel Sheets, "LUMINA COLOR"*

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1 Introduction

The use of colored stainless steel, which combines the advantages of conventional stainless steel with the aesthetic qualities of sophistication and stylishness, has recently increased, particularly in the field of construction materials. To cope with this trend, Kawasaki Steel has installed a continuous coloring line using a unique alternating current electrolyzing method at the Nishinomiya district of its Hanshin Works, making it possible to manufacture a line of colored stainless steel products tradenamed LUMINA COLOR, which has superb uniformity of color tone.

The following is an outline of the equipment and features of the LUMINA COLOR products.

2 Outline of Equipment

Equipment specifications are shown in **Table 1**, and the manufacturing process is shown in **Fig. 1**.

Main features of the equipment are shown below.

(1) Through several repetitions of alternating current electrolyzing, which features combined anodic electrolysis and cathodic electrolysis in a sulfuric acid-chromate solution, "coloring" and "film hardening" are achieved in a "one solution and one-step" process. The concentration and temperatures of the solution used are shown in **Table 2**.

(2) All conventional sheet coloring methods use the suspension method, but in this equipment, the stainless steel sheets are placed in a horizontal position and continuously fed into the line. Dispersion of color tone due to vibration of the sheet in the solution is prevented, and "grabbing" allowance for suspension is no longer required.

(3) Alternate current electrolyzing conditions for each color tone, which take into consideration the sheet size, grade, and surface finish, are automatically set up and controlled; for color tone inspection, colori-

Table 1 Main specifications

Capacity	100 t/Month (10 000 m²/month)
Size	
Thickness	0.3~3.0 mm
Width	max. 1 270 mm
Length	max. 8 000 mm
Line speed	0.2~2.0 m/min

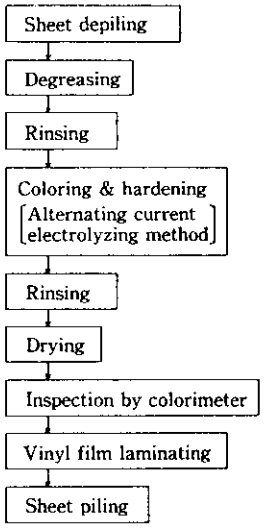

Fig. 1 Coloring process

Table 2 Concentration and temperature of coloring and hardening solution

Concentration	CrO_3	250 g/l
	H_2SO_4	490 g/l
Temperature	60°C	

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meters automatically measure and approve product quality.

(4) Manufacture of long products up to 8 m is possible.

3 Features of LUMINA COLOR Products

3.1 Uniformity and Reproducibility of Color Tone

Since this line is uses the company's unique alternating current electrolyzing method and has equipment functions which permit sophisticated color tone control, the color unformity and reproducibility of LUMINA COLOR products are excellent. Color difference are in the range of $\Delta E < 2$, at which visual inspection cannot detect differences in color tone. An example of a measured color value is given in **Fig. 2**.

Further, since sheets are continuously fed into the coloring line, unlike in the suspension method, sheet-to-sheet color differences are minimal and can be easily controlled.

3.2 Anticorrosion and Weather Resistance Properties

Corrosion resistance is shown in **Table 3**; weather resistance is shown in **Table 4**. These two characteristics of LUMINA COLOR are equal or superior to those of conventional chemically colored stainless steel or colored aluminum.

3.3 Workability and Impact Resistance

Workability and impact resistance are shown in **Table 5**. Since LUMINA COLOR, unlike colored aluminum, employs an interference color method using a thin oxide film, it has excellent workability and impact resistance.

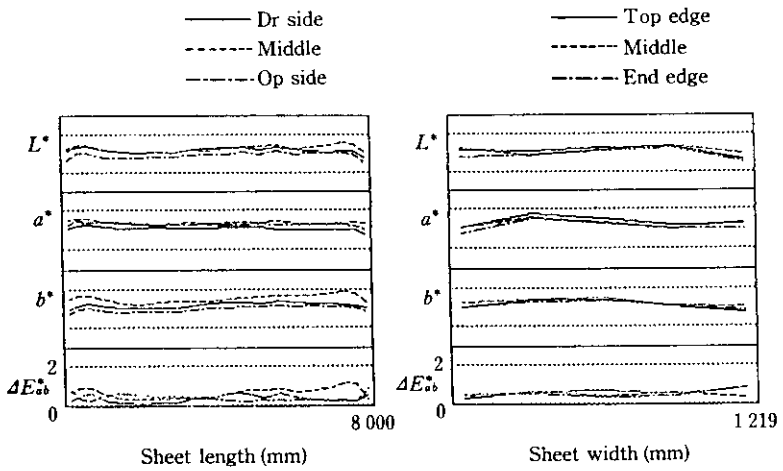

Fig. 2 Example of inspection by colorimeter (SUS304, 15HL finish, 1.50 mm × 1 219 mm × 8 000 mm)

Table 3 Anticorrosiveness

Test	Specimen	LUMINA COLOR (SUS 304)	Conventional colored stainless steel (SUS 304)	Enameled steel	Colored aluminum
SST (500 h)*1		No rust	No rust	No rust	Rust over entire face
CASS (500 h)*2		No rust (small stain at bend)	No rust (small stain at bend)	No rust	Rust over entire face
Acid immersion (room temp., 50 h)	10% HNO_3	No change	No change	No change	Color chaged slightly
	10% H_2SO_4	Color changed slightly	Color changed slightly	No change	Color changed a little
	10% HCl	Color faded	Color faded	No change	Substrate dissolved
Alkali immersion (room temp., 50 h)	10% NaOH	No change	No change	No change	Substrate dissolved
Boiling water immersion (98°C, 5 h)		Color changed at water line	Color changed at water line	No change	Color changed a little

*1 5% saline spray testing (35°C)—JIS Z 2371

*2 Copper-Accelerated Acetic Acid-Salt Spray Testing (JIS D 0201)

Table 4 Weather resistance

Test \ Specimen		LUMINA COLOR
Dew panel weather meter (3 000 h)		No change
Sunshine weather meter (4 000 h)		No change
Outdoor exposure (2 year)	Industrial zone	No change
	Marine industrial zone	No change

Table 5 Wear resistance and workability

Test \ Specimen	LUMINA COLOR	Conventional colored stainless steel	Enameled steel	Colored aluminum
Du Pont impact (1/2 inch)	>1 kg, 500 mm	>1 kg, 500 mm	<500 g, 50 mm	<500 g, 50 mm
90°C bending test ($r=2t$)	No change	No change	—	Cracked
Sand drip wear test (400 μ Al_2O_3, 10 l, 85 cm fall)	Changed white	Changed white	No change	No change

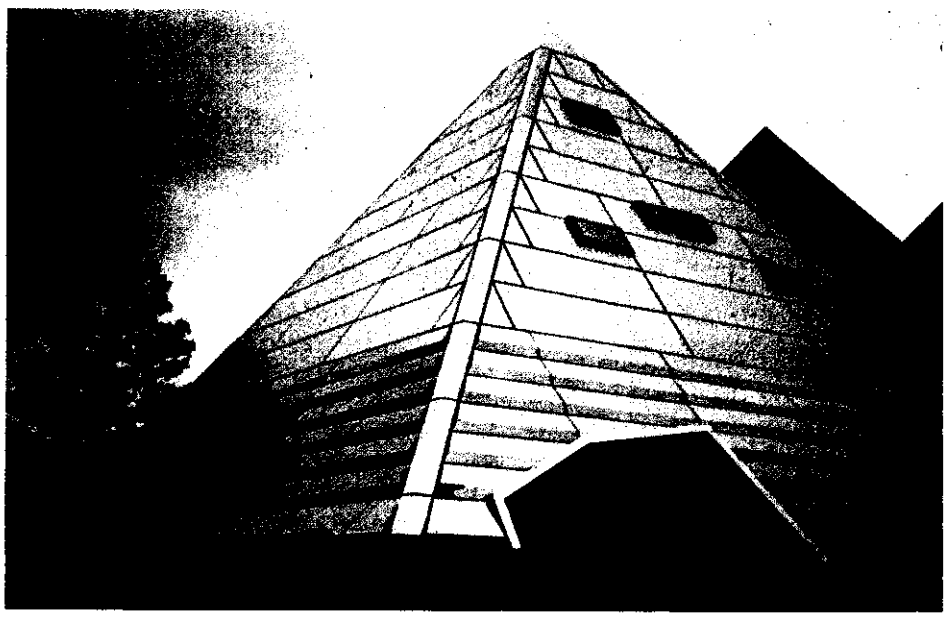

Photo 1 Structure using LUMINA COLOR

4 Concluding Remarks

LUMINA COLOR was jointly developed by Kawasaki Steel and Kinki Yakuhin Kogyo Co., Ltd. Through the recent completion of parallel manufacturing setups at the two companies, processing capacity has been increased and the manufacture of long products has become possible. In addition, customers' delivery and quality requirements can now be more easily met.

A recent example of construction using LUMINA COLOR is shown in **Photo 1**. The types of steel, surface finishes, and color tones available in the LUMINA COLOR line are to be expanded in the future.

For Further Information, Please Contact:

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