METALLURGICAL EVALUATION OF A "CONTROL" OVERLAY BOAT SAMPLE: CYLINDER NW 315° 10' ELEVATION

Prepared for:

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SUBJECT

METALLURGICAL EVALUATION OF A ”CONTROL” OVERLAY BOAT SAMPLE: CYLINDER NW 315° 10’ ELEVATION

BACKGROUND & ANALYSIS REQUESTED

A stainless steel overlay boat sample described as a “control” sample from a Pulp Mill Digester was received for metallurgical evaluation (Figures 1 and 2). The sample was removed from Cylinder NW 315° 10’ elevation. The overlay was of a dual SAW312-29 chemical composition. The author was asked to metallurgically evaluate the “control” sample including determining the following:

1. Chemical composition of the top pass.
2. Percent ferrite in the top pass directly off the surface.
3. Total thickness over the overlay and thickness of the individual passes.

ANALYTICAL PROCEDURES

I. Chemical Analysis:

A. Quantitative Analysis: Optical Emission Spectroscopy, ASTM E 1086-Latest Re-vision

I. Determination of Ferrite Content

A. Percentage ferrite using a Fischer Fischerscope® MP30 (i.e. magnetic permeability), ASTM A799-Latest Version, as measured directly off the surface of the top pass

RESULTS

The quantitative chemical analysis of the top weld pass from the boat sample is attached in Table 1.

The percentage ferrite numbers, i.e. average and range, measured from the surface of the top pass are attached in Table 2.

Weld bead thickness measurements are attached in Table 3 and also presented in Figure 4.

QUANTITATIVE CHEMICAL ANALYSIS: OPTICAL EMISSION SPECTROSCOPY

TABLE 1
OES CHEMICAL ANALYSIS OF THE TOP PASS

Values in Weight Percent

ELEMENT	CONTROL
Carbon	0.064
Manganese	1.74
Phosphorus	0.016
Sulfur	0.015
Silicon	0.64
Nickel	10.9
Chromium	26.2
Molybdenum	0.04
Copper	0.02
Vanadium	0.01
Niobium	<0.01
Titanium	<0.01
Aluminum	0.01
Cobalt	0.03
Tungsten	0.03
Iron	Matrix

FERRITE NUMBER MEASURED DIRECTLY OFF THE SURFACE

TABLE 2

Percentage Ferrite Directly Off Surface of the Top Pass

SAMPLE	Top Pass Percentage Ferrite Average (Range)
Control	48.2 (45.4 - 53.3)

THICKNESS OF WELD OVERLAY

TABLE 3

Weld Pass Thickness

SAMPLE	Total Max.	1. Base Pass	2. 2nd Pass	3. 3rd Pass	4. Top Pass
Control	0.372”	0.051”	0.114”	0.039”	0.164”

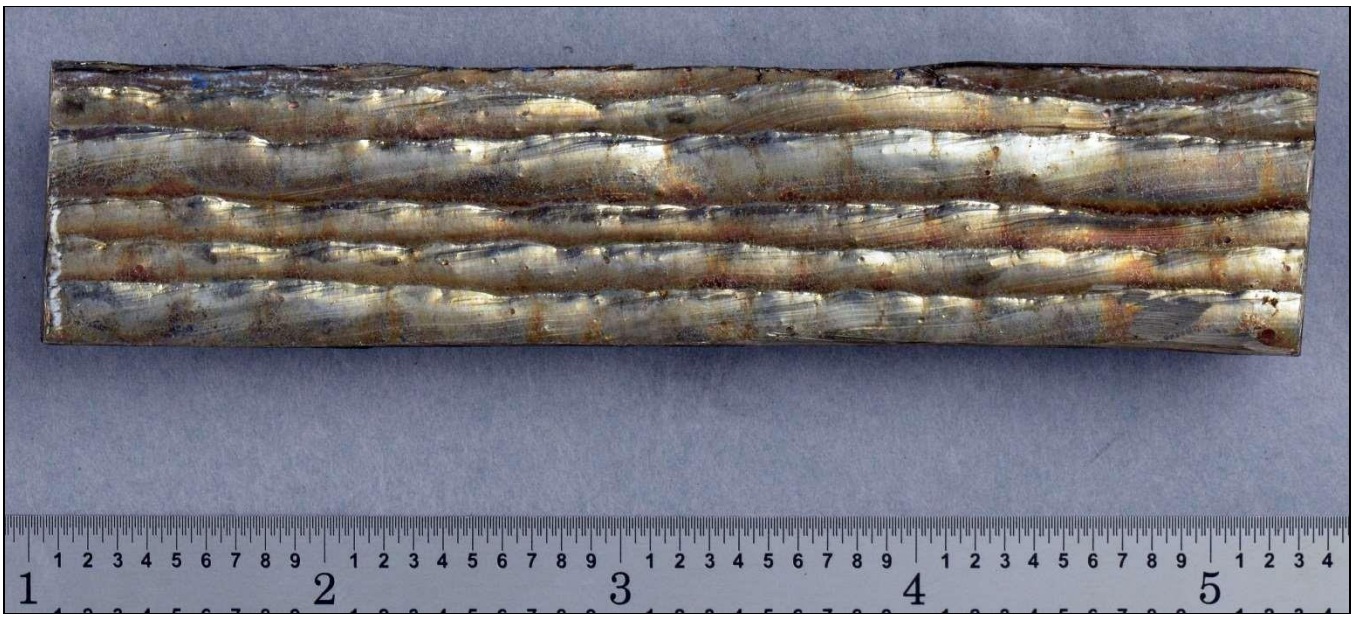

Figure 1. Photograph showing the surface of the "Control" overlay sample as-received (Scale 0.01" divisions).

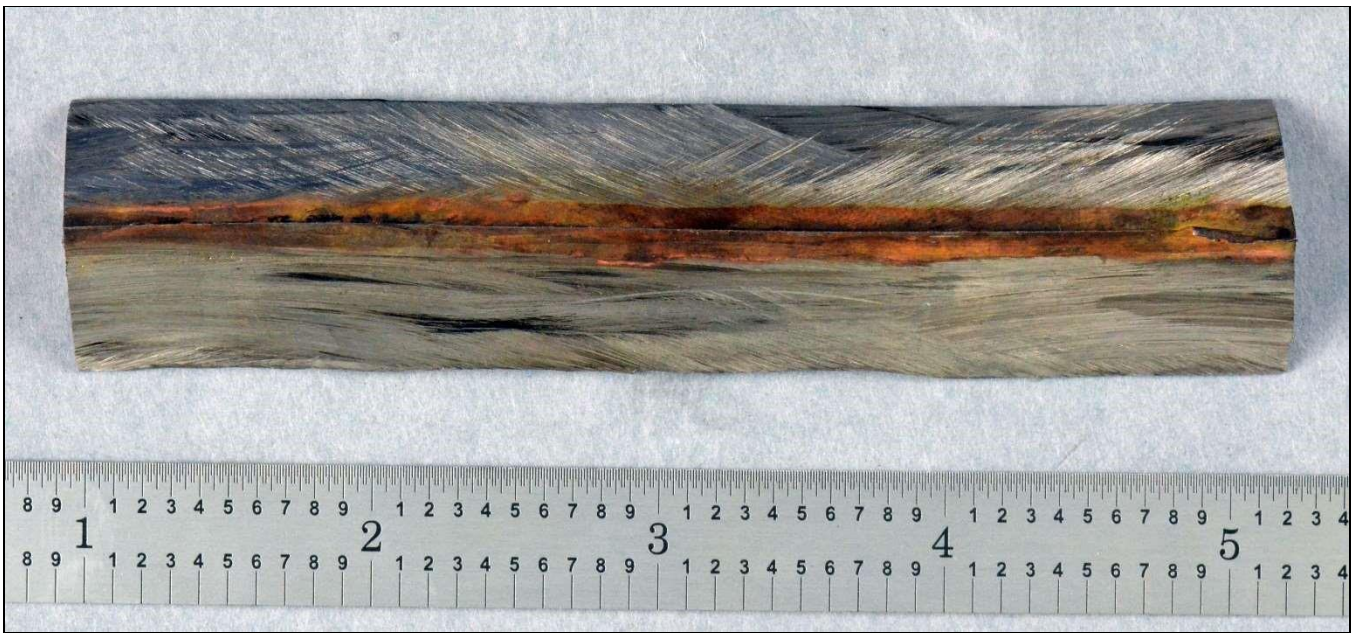

Figure 2. Photograph showing the surface of the "Control" overlay sample as-received (Scale 0.01" divisions).

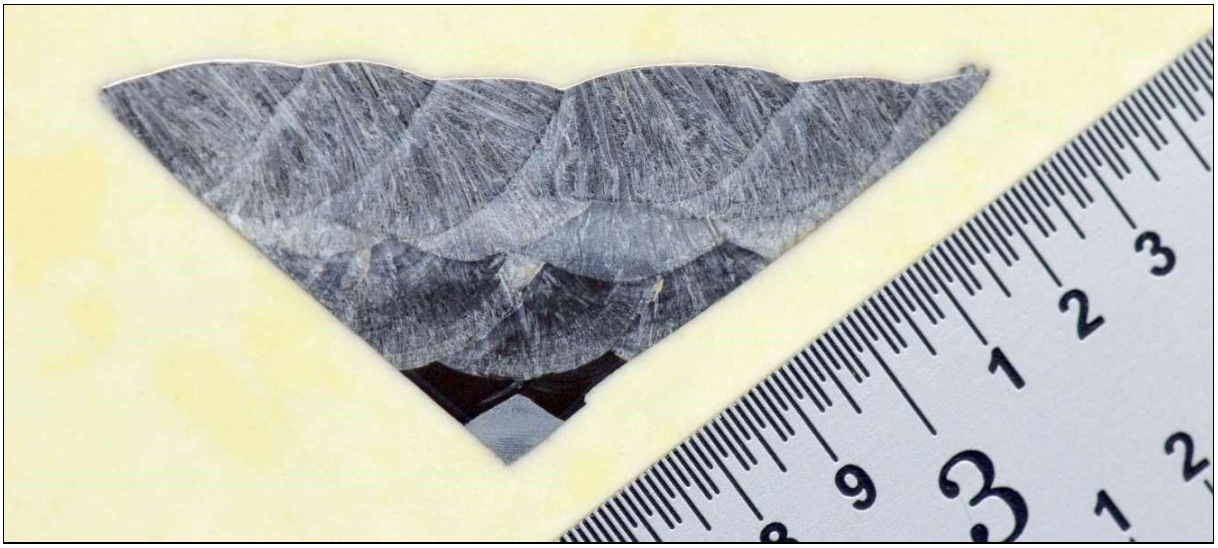

FIGURE 3. Etched cross section through Control sample. (NAOH Electrolytic etchant, Scale 0.01" divisions)

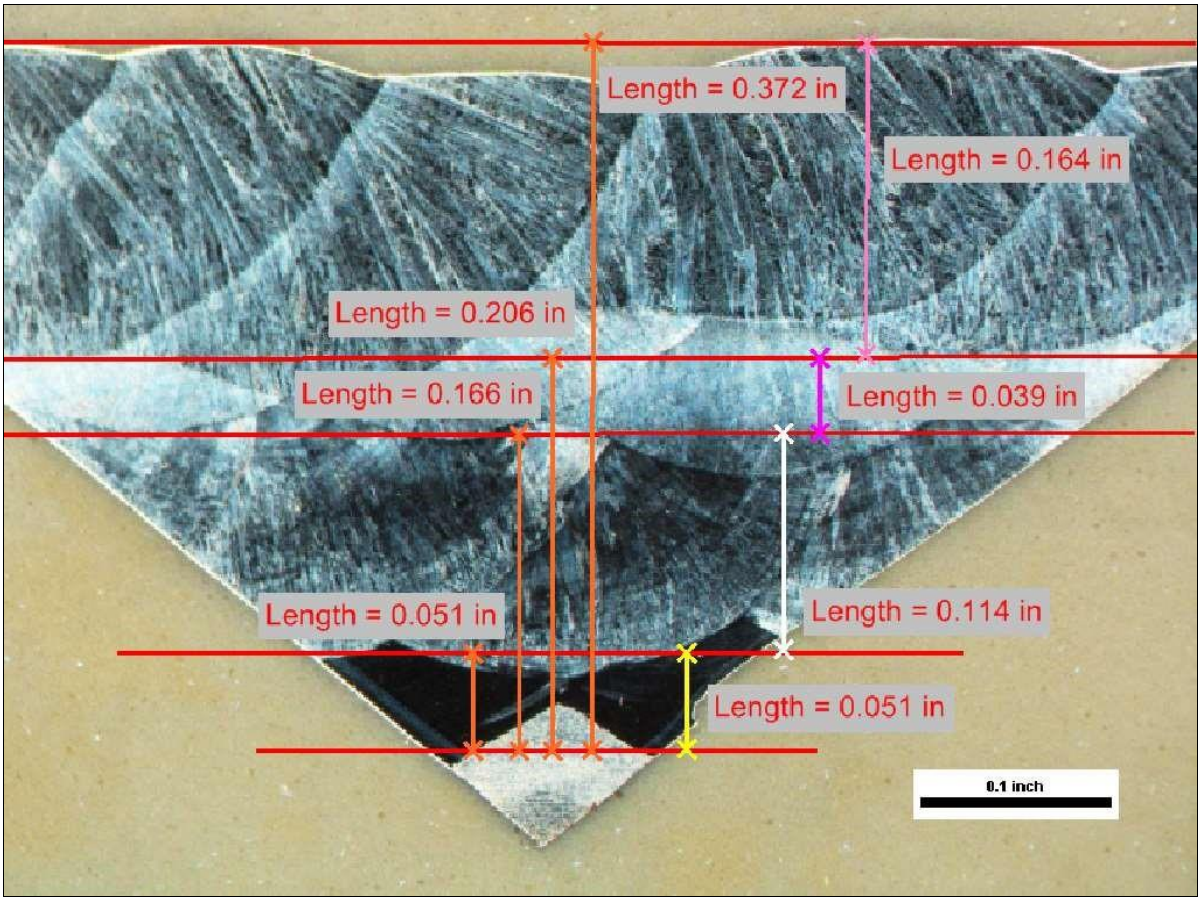

FIGURE 4. Etched cross section through Control sample, with thickness measurements superimposed. (NAOH Electrolytic etchant)