

APPENDIX A

Raw Data of Stainless Steel Weld Wire (316LS) Characterization

Table A1 Size distribution of the stainless steel weld wire (316LS) in-flight particles.

Size (μm)	Number of in-flight particle			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
0-20	2	3	2	2
20-40	16	14	18	20
40-60	51	48	59	61
60-80	22	20	13	13
80-100	7	10	4	2
100-120	2	5	4	2

Table A2 Size of the stainless steel weld wire (316LS) in-flight particles.

In-flight particle number	In-flight particle size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
1	62.5	85.7	42.8	57.1
2	75.0	71.4	42.8	71.4
3	50.0	42.8	42.8	28.5
4	75.0	42.8	57.1	42.8
5	37.5	42.8	28.5	42.8
6	37.5	42.8	28.5	28.5
7	112.5	42.8	28.5	42.8
8	50.0	57.1	57.1	42.8
9	62.5	57.1	42.8	42.8
10	75.0	114.2	42.8	42.8
11	87.5	57.1	28.5	42.8
12	75.0	57.1	28.5	28.5
13	75.0	71.4	28.5	42.8
14	100.0	85.7	28.5	42.8
15	62.5	85.7	42.8	42.8
16	62.5	57.1	42.8	42.8
17	50.0	71.4	42.8	71.4
18	37.5	42.8	42.8	57.1
19	37.5	42.8	42.8	57.1
20	75.0	71.4	42.8	42.8
21	50.0	28.5	42.8	57.1
22	37.5	57.1	42.8	42.8
23	50.0	28.5	42.8	42.8
24	75.0	42.8	57.1	42.8
25	50.0	28.5	57.1	42.8
26	100.0	100.0	57.1	28.5
27	62.5	28.5	57.1	57.1
28	62.5	42.8	57.1	42.8
29	62.5	57.1	42.8	42.8
30	62.5	57.1	42.8	42.8
31	62.5	85.7	42.8	42.8
32	50.0	42.8	42.8	42.8
33	50.0	57.1	42.8	42.8
34	37.5	71.4	57.1	42.8
35	25.0	57.1	57.1	57.1
36	62.5	57.1	42.8	57.1
37	62.5	71.4	42.8	57.1
38	62.5	57.1	28.5	57.1
39	62.5	71.4	42.8	42.8
40	62.5	71.4	42.8	57.1
41	62.5	57.1	28.5	57.1
42	75.0	57.1	28.5	57.1

Table A2 (continued) Size of the stainless steel weld wire (316LS) in-flight particles.

In-flight particle number	In-flight particle size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
43	37.5	42.8	28.5	42.8
44	75.0	42.8	28.5	42.8
45	50.0	42.8	42.8	42.8
46	100.0	42.8	42.8	42.8
47	37.5	28.5	57.1	42.8
48	50.0	28.5	42.8	57.1
49	62.5	42.8	42.8	57.1
50	62.5	42.8	42.8	71.4
51	62.5	71.4	85.7	42.8
52	62.5	57.1	42.8	42.8
53	50.0	28.5	42.8	42.8
54	62.5	57.1	42.8	57.1
55	25.0	42.8	42.8	57.1
56	37.5	28.5	42.8	28.5
57	62.5	57.1	42.8	28.5
58	50.0	42.8	42.8	28.5
59	37.5	42.8	42.8	28.5
60	62.5	85.7	42.8	28.5
61	62.5	42.8	57.1	57.1
62	50.0	42.8	57.1	42.8
63	62.5	42.8	57.1	71.4
64	62.5	57.1	57.1	57.1
65	75.0	71.4	57.1	28.5
66	50.0	57.1	57.1	28.5
67	50.0	42.8	42.8	28.5
68	37.5	71.4	42.8	28.5
69	37.5	42.8	42.8	28.5
70	50.0	100.0	57.1	28.5
71	50.0	114.2	57.1	42.8
72	50.0	57.1	71.4	42.8
73	50.0	42.8	71.4	42.8
74	62.5	28.5	71.4	28.5
75	50.0	28.5	71.4	57.1
76	62.5	57.1	57.1	57.1
77	37.5	28.5	57.1	42.8
78	75.0	42.8	57.1	42.8
79	100.0	42.8	57.1	42.8
80	50.0	42.8	57.1	42.8

Table A2 (continued) Size of the stainless steel weld wire (316LS) in-flight particles.

In-flight particle number	In-flight particle size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
81	125.0	71.4	57.1	42.8
82	37.5	57.1	57.1	42.8
83	37.5	57.1	57.1	42.8
84	37.5	57.1	71.4	57.1
85	50.0	42.8	71.4	57.1
86	62.5	100.0	71.4	42.8
87	62.5	71.4	57.1	42.8
88	62.5	71.4	57.1	42.8
89	62.5	71.4	57.1	42.8
90	37.5	71.4	57.1	42.8
91	37.5	71.4	57.1	42.8
92	37.5	42.8	57.1	42.8
93	50.0	57.1	57.1	42.8
94	75.0	28.5	57.1	42.8
95	50.0	42.8	57.1	71.4
96	62.5	42.8	57.1	57.1
97	37.5	71.4	42.8	71.4
98	50.0	71.4	57.1	57.1
99	37.5	71.4	57.1	57.1
100	50.0	71.4	57.1	57.1
Avg	57.5	56.6	45.4	46.1
Std	17.9	18.6	11.8	11.23

Table A3 Size distribution of the stainless steel weld wire (316LS) splats.

Size (μm)	Number of splat			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
60-80	0	0	0	1
80-100	0	0	0	4
100-120	0	1	1	6
120-140	0	1	3	4
140-160	2	12	13	6
160-180	2	6	7	8
180-200	3	10	17	16
200-220	7	27	5	8
220-240	3	10	7	9
240-260	4	6	21	11
260-280	5	6	4	8
280-300	20	16	5	5
300-320	8	2	4	4
320-340	11	1	7	3
340-360	17	1	3	4
360-380	5	1	2	2
380-400	4	0	0	1
400-420	3	0	0	0
420-440	4	0	0	0
440-460	1	0	0	0
460-480	1	0	0	0

Table A4 Size of the stainless steel weld wire (316LS) splats.

Splat number	Splat size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
1	357.1	285.7	242.8	657.1
2	142.8	357.1	157.1	200.0
3	571.4	214.2	328.5	214.2
4	285.7	357.1	328.5	371.4
5	428.5	500.0	371.4	285.7
6	428.5	285.7	314.2	257.1
7	357.1	214.2	385.7	800.0
8	428.5	142.8	157.1	257.1
9	428.5	142.8	185.7	185.7
10	214.2	214.2	157.1	142.8
11	285.7	142.8	200.0	342.8
12	428.5	214.2	242.8	242.8
13	357.1	428.5	300.0	357.1
14	428.5	428.5	171.4	214.2
15	285.7	642.8	157.1	185.7
16	285.7	285.7	214.2	228.5
17	500.0	142.8	371.4	528.5
18	285.7	500.0	314.2	242.8
19	285.71	214.2	385.7	242.8
20	428.5	285.7	157.1	114.2
21	357.1	285.7	185.7	128.5
22	571.4	214.2	157.1	114.2
23	214.2	357.1	157.1	128.5
24	142.8	214.2	242.8	171.4
25	571.4	142.8	300.0	114.2
26	142.8	214.2	171.4	228.5
27	142.8	214.2	157.1	514.2
28	714.2	428.5	214.2	371.4
29	571.4	285.7	242.8	185.7
30	214.2	285.7	242.8	114.2
31	428.5	285.7	157.1	128.5
32	285.7	214.2	328.5	171.4
33	357.1	214.2	328.5	128.5
34	142.8	357.1	371.4	71.43
35	500.0	285.7	314.2	114.2
36	357.1	571.4	385.7	585.7
37	357.1	428.5	157.1	157.1
38	357.1	328.5	185.7	285.7
39	428.5	500.0	157.1	300.0
40	571.4	357.1	242.8	514.2

Table A4 (continued) Size of the stainless steel weld wire (316LS) splats

Splat number	Splat size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
41	357.1	357.1	157.1	185.7
42	500.0	357.1	328.5	257.1
43	214.2	285.7	171.4	114.2
44	214.2	214.2	157.1	114.2
45	214.2	714.2	157.1	600.0
46	285.7	142.8	328.5	328.5
47	428.5	142.8	328.5	142.8
48	642.8	214.2	371.4	142.8
49	571.4	500.0	314.2	128.5
50	642.8	142.8	385.7	157.1
51	285.7	214.2	157.1	157.1
52	357.1	142.8	157.1	271.4
53	357.1	142.8	214.2	114.2
54	428.5	714.2	242.8	185.7
55	571.4	214.2	242.8	185.7
56	642.8	142.8	157.1	585.7
57	785.7	114.2	328.5	757.1
58	428.5	285.7	328.5	1000.0
59	285.7	142.8	371.4	457.1
60	214.2	214.2	314.2	628.5
61	214.2	357.1	385.7	571.4
62	285.7	500.0	157.1	428.5
63	142.8	257.1	185.7	614.2
64	142.8	428.5	242.8	428.5
65	285.7	285.7	242.8	342.8
66	142.8	214.2	157.1	228.5
67	357.1	214.2	328.5	242.8
68	571.4	214.2	328.5	228.5
69	571.4	285.7	371.4	171.4
70	357.1	285.7	314.2	285.7
71	357.1	285.7	385.7	242.8
72	285.7	214.2	157.1	200.0
73	285.7	142.8	185.7	342.8
74	285.71	171.4	328.5	171.4
75	285.7	542.8	328.5	228.5
76	428.5	214.2	371.4	300.0
77	571.4	757.1	314.2	457.1
78	500.0	185.7	385.7	142.8
79	285.7	242.8	157.1	171.4
80	500.0	214.2	185.7	242.8

Table A4 (continued) Size of the stainless steel weld wire (316LS) splats

Splat number	Splat size (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
81	428.5	214.2	242.8	428.5
82	428.5	428.5	242.8	385.7
83	571.4	214.2	157.1	171.4
84	428.5	214.2	328.5	128.5
85	571.4	285.7	328.5	100.0
86	285.7	400.0	300.0	114.2
87	500.0	214.2	171.4	500.0
88	857.1	285.7	157.1	457.1
89	500.0	142.8	157.1	914.2
90	571.4	142.8	328.5	71.43
91	357.1	142.8	328.5	171.4
92	357.1	285.7	371.4	185.7
93	571.4	314.2	314.2	100.0
94	428.5	285.7	385.7	114.2
95	357.1	314.2	157.1	114.2
96	142.8	285.7	157.1	100.0
97	285.7	285.7	328.5	85.71
98	285.7	285.7	314.2	200.0
99	642.8	214.2	385.7	280.6
100	428.5	428.5	328.5	191.9
Avg	289.2	220.4	254.4	182.3
Std	47.6	30.3	79.2	92.0

Table A5 Degree of splashing of the stainless steel weld wire (316LS) splats.

Splat number	Degree of splashing					
	200 mm, 420 kPa (C ₁)			200 mm, 520 kPa (C ₂)		
	P	A	DS	P	A	DS
1	1206.30	3313.00	34.97	844.45	1928.00	29.45
2	344.18	990.00	9.53	882.87	2968.00	20.91
3	2121.06	15280.00	23.44	464.46	957.00	17.95
4	770.69	2552.00	18.53	288.03	592.00	11.16
5	212.98	413.00	8.74	163.08	396.00	5.35
6	969.56	7156.00	10.46	1225.06	3015.00	39.63
7	237.99	1085.00	4.16	1255.57	4362.00	28.77
8	492.54	1807.00	10.69	572.47	3228.00	8.08
9	1195.15	5408.00	21.03	663.37	1729.00	20.26
10	1438.28	8816.00	18.68	206.70	2123.00	1.60
11	1374.97	8586.00	17.53	464.11	1313.00	13.06
12	954.12	8021.00	9.04	425.53	830.00	17.37
13	373.58	3836.00	2.90	774.72	1792.00	26.67
14	235.44	532.00	8.30	595.33	830.00	34.00
15	88.56	492.00	1.27	518.30	6152.00	3.48
16	896.24	3670.00	17.43	1113.70	4248.00	23.25
17	1549.05	16064.00	11.89	1831.93	9856.00	27.11
18	675.07	5090.00	7.13	691.67	2960.00	12.87
19	1846.08	8242.00	32.92	1304.37	4250.00	31.87
20	569.32	2510.00	10.28	971.04	3712.00	20.22
21	1108.56	7020.00	13.94	862.09	1313.00	45.07
22	740.46	1592.00	27.42	952.84	4052.00	17.84
23	666.28	3016.00	11.72	538.16	7482.00	3.08
24	644.49	2592.00	12.76	570.05	2004.00	12.91
25	423.42	752.00	18.98	1137.05	3914.00	26.30
26	911.58	3709.00	17.84	546.30	3790.00	6.27
27	613.16	2920.00	10.25	875.59	6152.00	9.92
28	871.79	16406.00	3.69	718.65	4470.00	9.20
29	1945.68	25008.00	12.05	665.96	1885.00	18.73
30	1083.57	21369.00	4.37	1637.06	11307.00	18.87
31	469.49	1988.00	8.83	1406.79	6509.00	24.21
32	319.77	782.00	10.41	969.68	3316.00	22.58
33	355.25	860.00	11.68	1305.13	5772.00	23.50
34	322.02	976.00	8.46	713.65	1380.00	29.38
35	222.08	590.00	6.66	925.72	1200.00	56.86
36	1603.73	7272.00	28.16	1197.56	2780.00	41.07
37	381.37	807.00	14.35	919.82	1846.00	36.49
38	305.83	366.00	20.35	1704.62	15768.00	14.67
39	238.19	524.00	8.62	2651.19	18706.00	29.92
40	99.60	611.00	1.29	1033.75	5833.00	14.59

Table A5 (continued) Degree of splashing of the stainless steel weld wire (316LS)
splats.

Splat number	Degree of splashing					
	200 mm, 420 kPa (C ₁)			200 mm, 520 kPa (C ₂)		
	P	A	DS	P	A	DS
41	1294.42	18502.00	7.21	1142.32	5394.00	19.26
42	1524.97	45824.00	4.04	1237.64	4421.00	27.59
43	506.35	4304.00	4.74	777.94	7764.00	6.21
44	1132.13	8016.00	12.73	1093.08	6796.00	14.00
45	516.80	1930.00	11.02	2778.35	8993.00	68.34
46	702.41	3125.00	12.57	1766.98	5684.00	43.73
47	204.83	470.00	7.11	594.12	749.00	37.52
48	201.31	760.00	4.25	376.22	328.00	34.36
49	349.16	1576.00	6.16	483.24	448.00	41.50
50	94.45	586.00	1.21	2827.97	19480.00	32.69
51	1206.30	3313.00	34.97	844.45	1928.00	29.45
52	344.18	990.00	9.53	882.87	2968.00	20.91
53	2121.06	15280.00	23.44	464.46	957.00	17.95
54	770.69	2552.00	18.53	288.03	592.00	11.16
55	212.98	413.00	8.74	163.08	396.00	5.35
56	969.56	7156.00	10.46	1225.06	3015.00	39.63
57	237.99	1085.00	4.16	1255.57	4362.00	28.77
58	492.54	1807.00	10.69	572.47	3228.00	8.08
59	1195.15	5408.00	21.03	663.37	1729.00	20.26
60	1438.28	8816.00	18.68	206.70	2123.00	1.60
61	1374.97	8586.00	17.53	464.11	1313.00	13.06
62	954.12	8021.00	9.04	425.53	830.00	17.37
63	373.58	3836.00	2.90	774.72	1792.00	26.67
64	235.44	532.00	8.30	595.33	830.00	34.00
65	88.56	492.00	1.27	518.30	6152.00	3.48
66	896.24	3670.00	17.43	1113.70	4248.00	23.25
67	1549.05	16064.00	11.89	1831.93	9856.00	27.11
68	675.07	5090.00	7.13	691.67	2960.00	12.87
69	1846.08	8242.00	32.92	1304.37	4250.00	31.87
70	569.32	2510.00	10.28	971.04	3712.00	20.22
71	1108.56	7020.00	13.94	862.09	1313.00	45.07
72	740.46	1592.00	27.42	952.84	4052.00	17.84
73	666.28	3016.00	11.72	538.16	7482.00	3.08
74	644.49	2592.00	12.76	570.05	2004.00	12.91
75	423.42	752.00	18.98	1137.05	3914.00	26.30
76	911.58	3709.00	17.84	546.30	3790.00	6.27
77	613.16	2920.00	10.25	875.59	6152.00	9.92
78	871.79	16406.00	3.69	718.65	4470.00	9.20
79	1945.68	25008.00	12.05	665.96	1885.00	18.73

Table A5 (continued) Degree of splashing of the stainless steel weld wire (316LS)
splats.

Splat number	Degree of splashing					
	200 mm, 420 kPa (C ₁)			200 mm, 520 kPa (C ₂)		
	P	A	DS	P	A	DS
80	1083.57	21369.00	4.37	1637.06	11307.00	18.87
81	469.49	1988.00	8.83	1406.79	6509.00	24.21
82	319.77	782.00	10.41	969.68	3316.00	22.58
83	355.25	860.00	11.68	1305.13	5772.00	23.50
84	322.02	976.00	8.46	713.65	1380.00	29.38
85	222.08	590.00	6.66	925.72	1200.00	56.86
86	1603.73	7272.00	28.16	1197.56	2780.00	41.07
87	381.37	807.00	14.35	919.82	1846.00	36.49
88	305.83	366.00	20.35	1704.62	15768.00	14.67
89	238.19	524.00	8.62	2651.19	18706.00	29.92
90	99.60	611.00	1.29	1033.75	5833.00	14.59
91	1294.42	18502.00	7.21	1142.32	5394.00	19.26
92	1524.97	45824.00	4.04	1237.64	4421.00	27.59
93	506.35	4304.00	4.74	777.94	7764.00	6.21
94	1132.13	8016.00	12.73	1093.08	6796.00	14.00
95	516.80	1930.00	11.02	2778.35	8993.00	68.34
96	702.41	3125.00	12.57	1766.98	5684.00	43.73
97	204.83	470.00	7.11	594.12	749.00	37.52
98	201.31	760.00	4.25	376.22	328.00	34.36
99	349.16	1576.00	6.16	483.24	448.00	41.50
100	94.45	586.00	1.21	2827.97	19480.00	32.69
Avg	-	-	12.04	-	-	23.59
SD	-	-	7.79	-	-	13.93

Table A5 (continued) Degree of splashing of the stainless steel weld wire (316LS)
splats.

Splat number	Degree of splashing					
	300 mm, 420 kPa (C ₃)			300 mm, 520 kPa (C ₄)		
	P	A	DS	P	A	DS
1	437.09	800.00	19.01	2281.50	17548.00	23.62
2	602.08	1313.00	21.98	634.22	2168.00	14.77
3	651.02	1040.00	32.45	1118.62	9179.00	10.85
4	1056.02	1664.00	53.36	531.79	1135.00	19.84
5	995.89	1741.00	45.36	946.98	6118.00	11.67
6	1094.94	2688.00	35.51	539.88	1626.00	14.27
7	756.19	1744.00	26.10	625.19	4476.00	6.95
8	885.09	2778.00	22.45	1247.73	48640.00	2.55
9	358.97	616.00	16.65	663.08	3472.00	10.08
10	513.00	1085.00	19.31	1050.69	4128.00	21.29
11	782.78	4007.00	12.18	850.10	1888.00	30.48
12	454.69	1226.00	13.43	2125.04	26302.00	13.67
13	786.66	2166.00	22.75	530.76	1585.00	14.15
14	560.89	1776.00	14.10	1592.12	18940.00	10.66
15	481.14	753.00	24.48	684.43	3160.00	11.80
16	352.16	928.00	10.64	413.93	1164.00	11.72
17	370.86	860.00	12.73	551.84	3284.00	7.38
18	437.09	800.00	19.01	391.62	812.00	15.04
19	602.08	1313.00	21.98	938.82	4779.00	14.68
20	651.02	1040.00	32.45	562.37	1410.00	17.86
21	1056.02	1664.00	53.36	472.15	640.00	27.73
22	995.89	1741.00	45.36	793.20	3024.00	16.57
23	1094.94	2688.00	35.51	485.03	1456.00	12.86
24	756.19	1744.00	26.10	797.24	5357.00	9.45
25	885.09	2778.00	22.45	1043.36	13774.00	6.29
26	358.97	616.00	16.65	490.31	1312.00	14.59
27	513.00	1085.00	19.31	591.75	1524.00	18.29
28	782.78	4007.00	12.18	1377.56	4952.00	30.51
29	454.69	1226.00	13.43	313.80	882.00	8.89
30	786.66	2166.00	22.75	382.97	1020.00	11.45
31	560.89	1776.00	14.10	315.21	907.00	8.72
32	481.14	753.00	24.48	241.38	552.00	8.40
33	352.16	928.00	10.64	273.12	728.00	8.16
34	370.86	860.00	12.73	818.30	2326.00	22.92
35	437.09	800.00	19.01	243.14	535.00	8.80
36	602.08	1313.00	21.98	570.52	1354.00	19.14
37	651.02	1040.00	32.45	230.45	413.00	10.24
38	1056.02	1664.00	53.36	890.15	8784.00	7.18
39	995.89	1741.00	45.36	1344.41	11046.00	13.03
40	1094.94	2688.00	35.51	723.78	2082.00	20.03

Table A5 (continued) Degree of splashing of the stainless steel weld wire (316LS)
splats.

Splat number	Degree of splashing					
	300 mm, 420 kPa (C ₃)			300 mm, 520 kPa (C ₄)		
	P	A	DS	P	A	DS
41	756.19	1744.00	26.10	1280.93	16098.00	8.11
42	885.09	2778.00	22.45	386.09	508.00	23.36
43	358.97	616.00	16.65	426.54	1312.00	11.04
44	513.00	1085.00	19.31	293.29	514.00	13.32
45	782.78	4007.00	12.18	315.28	884.00	8.95
46	454.69	1226.00	13.43	619.21	3220.00	9.48
47	786.66	2166.00	22.75	430.62	1354.00	10.90
48	560.89	1776.00	14.10	337.21	612.00	14.79
49	481.14	753.00	24.48	364.30	1700.00	6.22
50	352.16	928.00	10.64	1092.66	44386.00	2.14
51	370.86	860.00	19.01	593.54	3524.00	7.96
52	437.09	800.00	21.98	1866.23	57232.00	4.85
53	602.08	1313.00	32.45	1277.48	56902.00	2.28
54	651.02	1040.00	53.36	1356.64	6150.00	23.83
55	1056.02	1664.00	45.36	340.67	540.00	17.11
56	995.89	1741.00	35.51	495.96	1019.00	19.22
57	1094.94	2688.00	26.10	158.97	274.00	7.34
58	756.19	1744.00	22.45	422.46	640.00	22.20
59	885.09	2778.00	16.65	590.00	3232.00	8.58
60	358.97	616.00	19.31	414.28	2580.00	5.30
61	513.00	1085.00	12.18	556.95	2758.00	8.95
62	782.78	4007.00	13.43	345.93	895.00	10.65
63	454.69	1226.00	22.75	408.83	1778.00	7.48
64	786.66	2166.00	14.10	880.30	6426.00	9.60
65	560.89	1776.00	24.48	1025.39	9730.00	8.60
66	481.14	753.00	10.64	1754.11	32492.00	7.54
67	352.16	928.00	12.73	550.61	6434.00	3.75
68	370.86	860.00	19.01	551.66	3117.00	7.77
69	437.09	800.00	21.98	2281.50	17548.00	23.62
70	602.08	1313.00	32.45	634.22	2168.00	14.77
71	651.02	1040.00	53.36	1118.62	9179.00	10.85
72	1056.02	1664.00	45.36	531.79	1135.00	19.84
73	995.89	1741.00	35.51	946.98	6118.00	11.67
74	1094.94	2688.00	26.10	539.88	1626.00	14.27
75	756.19	1744.00	22.45	625.19	4476.00	6.95
76	885.09	2778.00	16.65	1247.73	48640.00	2.55
77	358.97	616.00	19.31	663.08	3472.00	10.08
78	513.00	1085.00	12.18	1050.69	4128.00	21.29

Table A5 (continued) Degree of splashing of the stainless steel weld wire (316LS)
splats.

Splat number	Degree of splashing					
	300 mm, 420 kPa (C ₃)			300 mm, 520 kPa (C ₄)		
	P	A	DS	P	A	DS
79	782.78	4007.00	13.43	850.10	1888.00	30.48
80	454.69	1226.00	22.75	2125.04	26302.00	13.67
81	786.66	2166.00	14.10	530.76	1585.00	14.15
82	560.89	1776.00	24.48	1592.12	18940.00	10.66
83	481.14	753.00	10.64	684.43	3160.00	11.80
84	352.16	928.00	12.73	413.93	1164.00	11.72
85	370.86	860.00	19.01	551.84	3284.00	7.38
86	437.09	800.00	21.98	391.62	812.00	15.04
87	602.08	1313.00	32.45	938.82	4779.00	14.68
88	651.02	1040.00	53.36	562.37	1410.00	17.86
89	1056.02	1664.00	45.36	472.15	640.00	27.73
90	995.89	1741.00	35.51	793.20	3024.00	16.57
91	1094.94	2688.00	26.10	485.03	1456.00	12.86
92	756.19	1744.00	22.45	797.24	5357.00	9.45
93	885.09	2778.00	16.65	1043.36	13774.00	6.29
94	358.97	616.00	19.31	490.31	1312.00	14.59
95	513.00	1085.00	12.18	591.75	1524.00	18.29
96	782.78	4007.00	13.43	1377.56	4952.00	30.51
97	454.69	1226.00	22.75	313.80	882.00	8.89
98	786.66	2166.00	14.10	382.97	1020.00	11.45
99	560.89	1776.00	24.48	315.21	907.00	8.72
100	481.14	753.00	10.64	241.38	552.00	8.40
Avg	-	-	23.89	-	-	13.15
SD	-	-	11.73	-	-	6.60

Table A6 Distribution of the stainless steel weld wire (316LS) degree of splashing..

Degree of splashing	Number of in-flight particle			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
0-10	44	18	0	37
10-20	42	26	46	48
20-30	10	30	30	11
30-40	4	14	12	4
40-50	0	8	6	0
50-60	0	2	6	0
70-80	0	2	0	0

Table A7 Coating thickness of stainless steel 316LS coatings.

Location Number	Thickness (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
1	70	70	130	140
2	80	90	40	180
3	65	90	60	160
4	75	100	60	140
5	70	90	80	155
6	50	120	90	160
7	70	80	75	140
8	70	80	100	160
9	70	80	80	170
10	60	70	100	180
11	70	70	110	150
12	75	90	75	130
13	90	90	80	150
14	60	80	80	180
15	90	70	90	150
16	60	65	100	150
17	70	90	70	160
18	80	100	70	170
19	50	90	95	170
20	80	105	115	190
21	50	100	60	160
22	85	100	160	160
23	60	95	180	120
24	70	80	160	160
25	40	115	60	140
26	60	95	90	130
27	75	120	90	180
28	80	95	100	120
29	70	60	90	130
30	70	80	80	145
Avg	68.8	88.7	92.3	151.7
Stdv	11.9	15.3	31.4	17.7

Table A8 Roughness of stainless steel 316LS coatings.

Location Number	Roughness (μm)			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
1	10.2	10.2	12.2	12.8
2	10.8	11.0	10.8	11.6
3	10.2	11.6	10.4	12.6
4	10.6	11.2	11.8	11.0
5	11.2	11.0	12.6	10.2
6	11.0	10.0	11.4	10.0
7	10.9	10.8	11.2	12.0
8	10.0	11.6	11.2	12.2
9	10.2	10.8	10.4	11.6
10	10.2	11.2	11.8	13.0
11	11.0	12.6	11.2	12.4
12	9.6	10.8	11.6	13.2
13	10.4	12.2	10.2	11.0
14	10.8	11.8	11.0	10.2
15	10.4	11.4	11.0	12.8
Avg	10.5	11.2	11.3	11.9
Stdv	0.4	0.4	0.5	0.9

Table A9 Percentage porosity and oxide of stainless steel 316LS coatings.

Location Number	C ₁		C ₂	
	200 mm, 420 kPa		200 mm, 520 kPa	
	% porosity	% oxide	% porosity	% oxide
1	10.69	14.38	15.39	23.20
2	12.58	20.63	15.49	16.30
3	13.24	24.41	9.89	22.41
4	12.72	19.35	11.63	15.36
5	10.06	22.68	11.90	26.38
6	8.84	25.10	10.70	26.87
7	17.84	25.68	11.56	24.56
8	13.97	24.27	14.10	28.90
9	17.11	32.97	13.10	26.70
10	15.57	34.46	13.05	24.91
Avg	13.26	24.39	12.88	23.56
Stdv	2.96	5.96	2.04	4.49

Location Number	C ₃		C ₄	
	300 mm, 420 kPa		300 mm, 520 kPa	
	% porosity	% oxide	% porosity	% oxide
1	14.63	27.05	10.48	30.77
2	13.05	23.42	7.53	27.84
3	22.31	23.68	7.37	28.40
4	16.89	32.11	12.26	35.02
5	20.69	25.39	9.14	32.63
6	16.60	26.67	12.45	31.40
7	13.09	24.90	9.25	28.56
8	14.31	25.03	8.24	27.26
9	11.50	26.32	7.78	28.77
10	14.83	26.03	9.03	28.84
Avg	15.79	26.06	9.35	29.94
Stdv	3.43	2.44	1.84	2.46

Table A10 Hardness of stainless steel 316LS weld wire [48].

Location Number	Hardness (HV _{300g})
1	389.3
2	417.3
3	397.4
4	409.7
5	411.0
6	415.1
7	403.2
8	398.2
9	403.1
10	399.5
Avg	404.4
Std	8.8

Table A11 Hardness of stainless steel 316LS coatings.

Location Number	Hardness (HV _{300g})			
	200 mm, 420 kPa (C ₁)	200 mm, 520 kPa (C ₂)	300 mm, 420 kPa (C ₃)	300 mm, 520 kPa (C ₄)
1	244.5	294.9	296.4	334.7
2	234.1	307.2	281.7	293.4
3	231.3	272.2	314.3	335.3
4	282.6	309.8	245.5	376.1
5	257.0	270.2	274.8	356.4
6	274.4	261.9	270.5	364.6
7	264.1	326.5	314.4	396.6
8	269.7	307.4	336.3	363.8
9	248.9	281.4	257.2	357.3
10	241.1	324.4	277.1	349.9
Avg	254.8	295.6	286.8	352.8
Stdv	17.6	23.1	28.2	27.7

Table A12 Abrasive wear data of stainless steel coating under spray condition 1.

Distance (m)	Sample mass (g)	Mass loss (g)
0	27.5709	0
50	27.5420	28.9
100	27.5175	53.4
150	27.4960	74.9
200	27.4702	100.7
250	27.4476	123.3

Table A13 Abrasive wear data of stainless steel coating under spray condition 2.

Distance (m)	Sample mass (g)	Mass loss (g)
0	28.2485	0
50	28.2236	24.9
100	28.2041	44.0
150	28.1836	64.9
200	28.1666	81.9
250	28.1470	101.5

Table A14 Abrasive wear data of stainless steel coating under spray condition 3.

Distance (m)	Sample mass(g)	Mass loss (g)
0	28.4276	0
50	28.4001	27.5
100	28.3082	47.4
150	28.3610	66.6
200	28.3438	83.8
250	28.3268	100.8

Table A15 Abrasive wear of stainless steel coating under spray condition 4.

Distance (m)	Sample mass(g)	Mass loss (g)
0	26.8267	0
50	26.8153	11.4
100	26.8070	19.7
150	26.7985	28.2
200	26.7908	35.9
250	26.7818	44.9

Table A16 Sliding wear of stainless steel 316LS coating under spray condition 1.

No	Track wide (μm)			
	50 (m)	75 (m)	100 (m)	125 (m)
1	256.2	305.0	341.0	358.0
2	287.0	297.3	379.0	390.0
3	287.9	254.4	317.4	391.6
4	202.9	307.4	377.3	371.2
Avg	258.5	291.0	353.7	377.7

Table A17 Sliding wear of stainless steel 316LS coating under spray condition 2.

No	Track wide (μm)			
	50 (m)	75 (m)	100 (m)	125 (m)
1	277.1	329.1	342.8	355.6
2	290.0	300.4	337.2	356.1
3	288.4	316.9	327.8	335.3
4	256.1	300.1	343.0	367.6
Avg	277.9	311.6	337.7	353.7

Table A18 Sliding wear of stainless steel 316LS coating under spray condition 3.

No	Track wide (μm)			
	50 (m)	75 (m)	100 (m)	125 (m)
1	414.0	377.2	400.3	356.9
2	387.3	389.9	385.9	381.1
3	412.9	427.4	380.2	390.6
4	374.2	408.1	388.3	333.0
Avg	397.1	400.7	388.7	356.4

Table A19 Sliding wear of stainless steel 316LS coating under spray condition 4.

No	Track wide (μm)			
	50 (m)	75 (m)	100 (m)	125 (m)
1	106.5	126.1	143.5	155.2
2	109.6	128.9	133.0	152.9
3	102.0	123.2	141.5	159.8
4	104.0	116.7	137.0	150.1
Avg	105.6	123.7	138.8	154.5

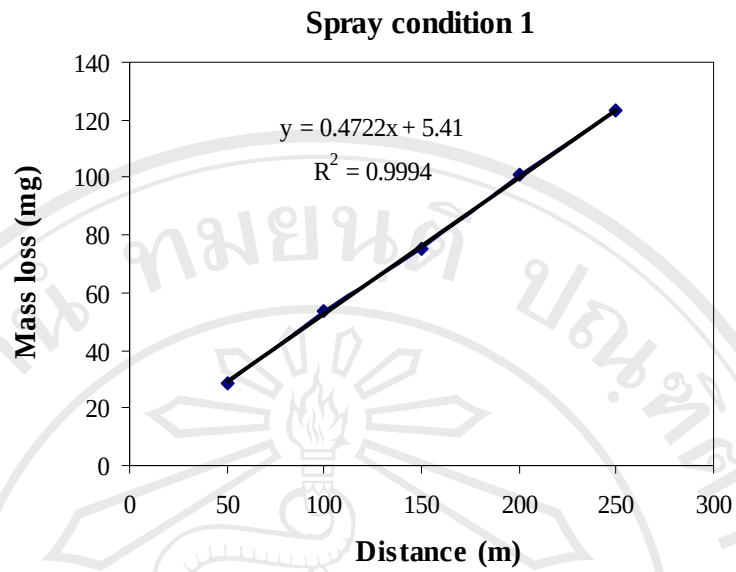


Figure A1 Abrasive wear rate of stainless steel 316LS coating produced under condition 1

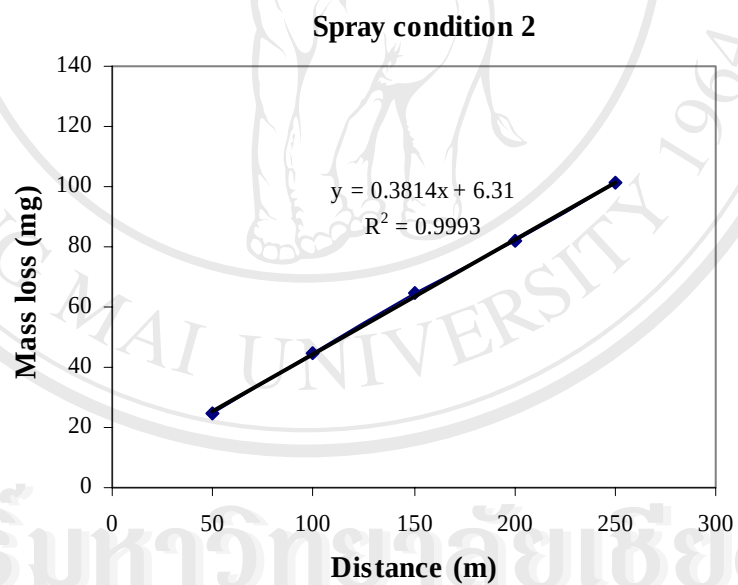


Figure A2 Abrasive wear rate of stainless steel 316LS coating produced under condition 2

Spray condition 3

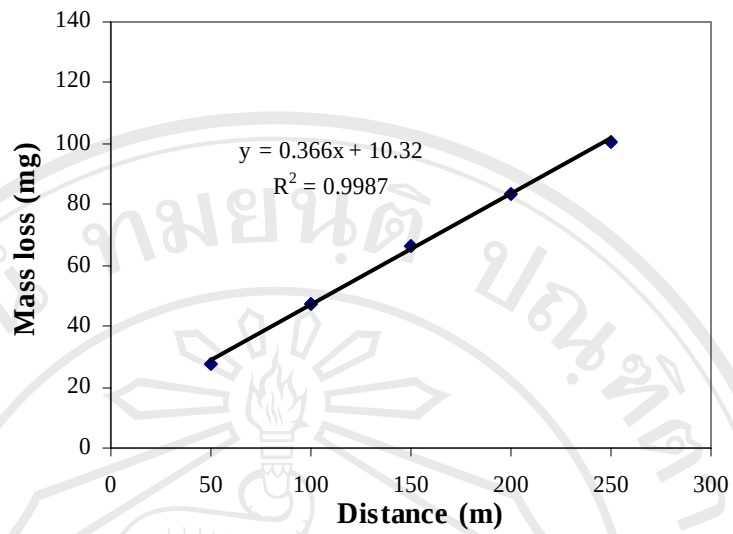


Figure A3 Abrasive wear rate of stainless steel 316LS coating produced under condition 3

Spray condition 4

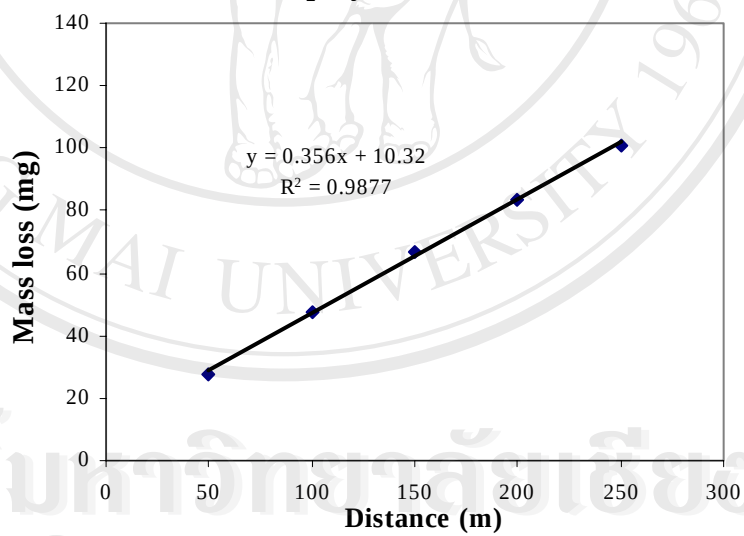


Figure A4 Abrasive wear rate of stainless steel 316LS coating produced under condition 4

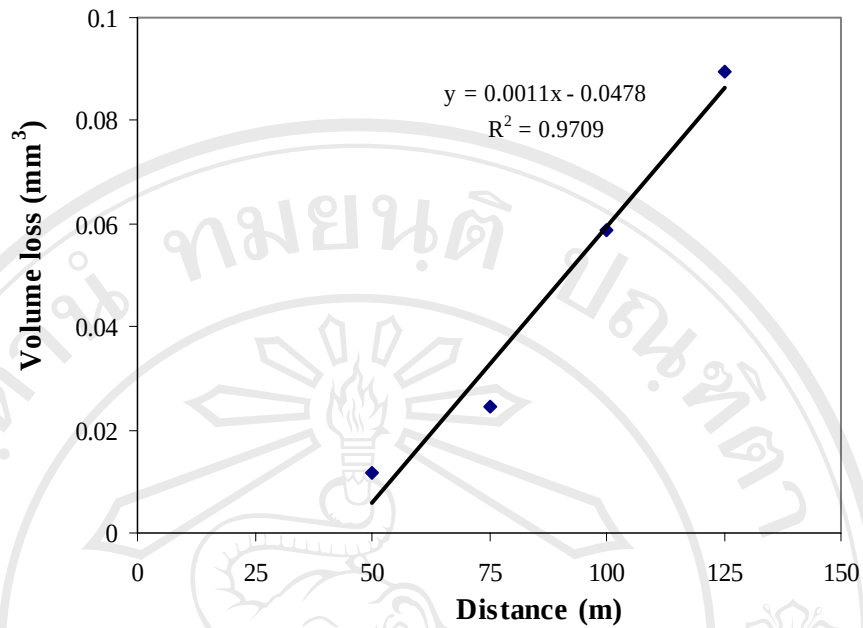
Spray condition 1

Figure A5 Sliding wear rate of stainless steel 316LS coating produced under condition 1

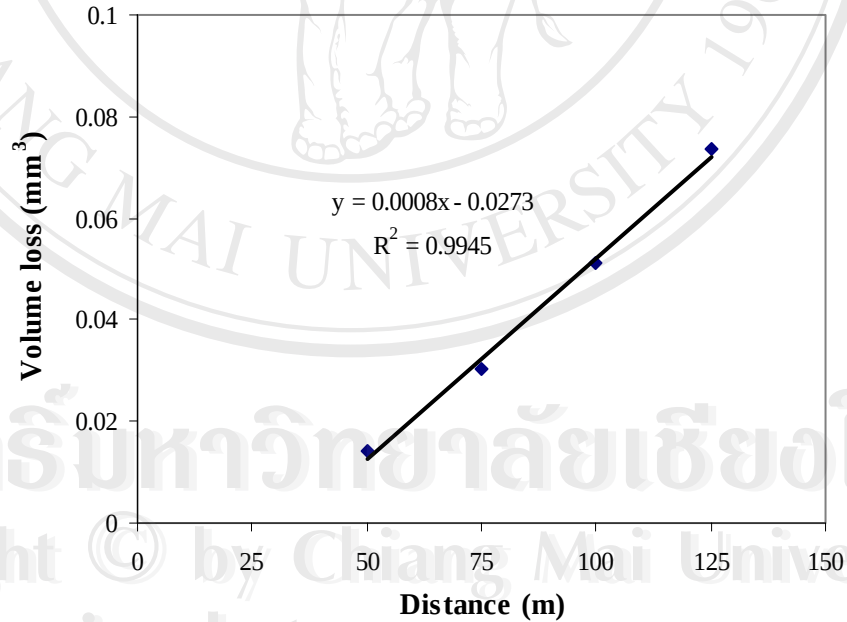
Spray condition 2

Figure A6 Sliding wear rate of stainless steel 316LS coating produced under condition 2

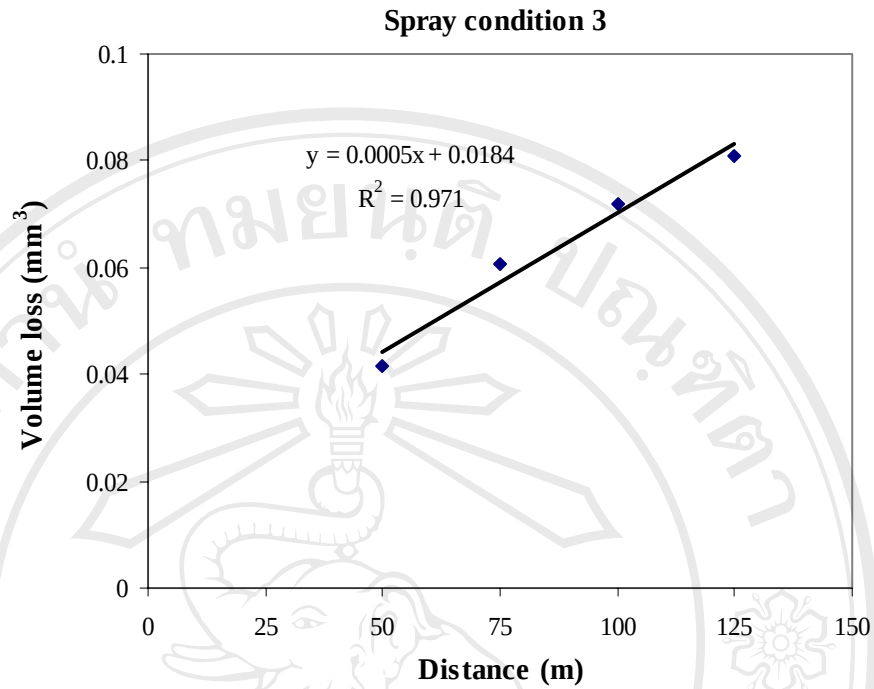


Figure A7 Sliding wear rate of stainless steel 316LS coating produced under condition 3

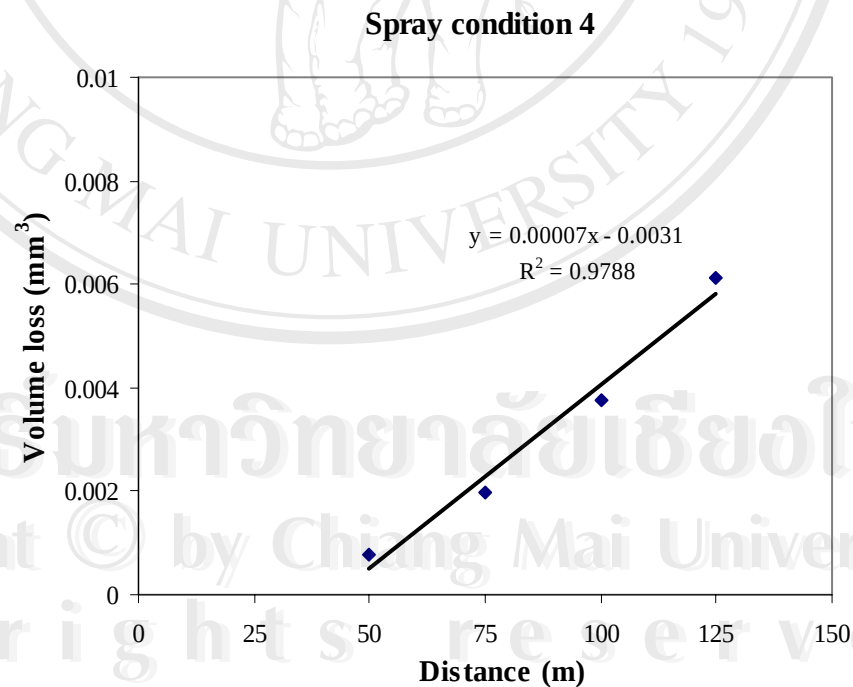


Figure A8 Sliding wear rate of stainless steel 316LS coating produced under condition 4

APPENDIX B

Raw Data of Stainless Steel Arc Wire (316L) Characterization

Table B1 Size distribution of the stainless steel arc wire (316L) in-flight particles.

Size (μm)	Number of in-flight particle
0-10	24
10-20	60
20-30	6
30-40	6
40-50	4

Table B2 Size of the stainless steel arc wire (316L) in-flight particles.

In-flight particle number	In-flight particle size (μm)
1	30.30
2	12.12
3	6.06
4	6.06
5	12.12
6	18.18
7	24.24
8	18.18
9	12.12
10	36.36
11	30.30
12	42.42
13	48.48
14	48.48
15	42.42
16	36.36
17	36.36
18	30.30
19	12.12
20	18.18

Table B2 (continued) Size of the stainless steel arc wire (316L) in-flight particles.

In-flight particle number	In-flight particle size (μm)
21	12.12
22	6.06
23	6.06
24	18.18
25	12.12
26	6.06
27	12.12
28	12.12
29	6.06
30	12.12
31	18.18
32	18.18
33	18.18
34	12.12
35	6.06
36	12.12
37	12.12
38	12.12
39	18.18
40	12.12
41	18.18
42	12.12
43	12.12
44	12.12
45	18.18
46	18.18
47	12.12
48	12.12
49	18.18
50	6.06
51	6.06
52	6.06
53	12.12
54	18.18
55	24.24
56	12.12
57	12.12
58	6.06
59	6.06
60	6.06

Table B2 (continued) Size of the stainless steel arc wire (316L) in-flight particles.

In-flight particle number	In-flight particle size (μm)
61	24.24
62	12.12
63	18.18
64	12.12
65	12.12
66	12.12
67	6.06
68	6.06
69	6.06
70	12.12
71	12.12
72	12.12
73	12.12
74	18.18
75	12.12
76	12.12
77	12.12
78	6.06
79	6.06
80	6.06
81	18.18
82	24.24
83	6.06
84	18.18
85	18.18
86	12.12
87	12.12
88	6.06
89	24.24
90	18.18
91	24.24
92	12.12
93	18.18
94	12.12
95	12.12
96	12.12
97	6.06

Table B2 (continued) Size of the stainless steel arc wire (316L) in-flight particles.

In-flight particle number	In-flight particle size (μm)
98	6.06
99	6.06
100	12.12
Avg	15.21
SD	9.42

Table B3 Size distribution of stainless steel arc wire (316L) splats.

Size (μm)	Number of splat
50-100	2
100-150	8
150-200	12
200-250	20
250-300	13
300-350	9
350-400	9
400-450	7
450-500	10
500-550	5
550-600	2
600-650	3

Table B4 Size of stainless steel arc wire (316L) splats.

Splat number	Splat size (μm)
1	342.9
2	371.4
3	228.6
4	457.1
5	285.7
6	528.6
7	271.4
8	457.1
9	214.3
10	242.9
11	328.6
12	285.7
13	600.0
14	457.1
15	214.3
16	214.3
17	385.7
18	471.4
19	214.3
20	400.0
21	257.1
22	257.1
23	157.1
24	128.6
25	114.3
26	314.3
27	157.1
28	128.6
29	185.7
30	128.6
31	428.6
32	342.9
33	128.6
34	85.7
35	457.1
36	214.3
37	300.0
38	171.4
39	428.6
40	200.0

Table B4 (continued) Size of stainless steel arc wire (316L) splats.

Splat number	Splat size (μm)
41	157.1
42	542.9
43	185.7
44	142.9
45	228.6
46	214.3
47	414.3
48	328.6
49	200.0
50	485.7
51	171.4
52	85.7
53	342.9
54	457.1
55	214.3
56	242.9
57	171.4
58	200.0
59	557.1
60	342.9
61	142.9
62	142.9
63	228.6
64	200.0
65	385.7
66	271.4
67	214.3
68	385.7
69	242.9
70	428.6
71	371.4
72	357.1
73	157.1
74	257.1
75	185.7
76	185.7
77	242.9
78	500.0
79	457.1

Table B4 (continued) Size of stainless steel arc wire (316L) splats.

Splat number	Splat size (μm)
80	557.1
81	357.1
82	271.4
83	171.4
84	528.6
85	600.0
87	257.1
88	257.1
89	200.0
90	457.1
91	371.4
92	642.9
93	414.3
94	428.6
95	257.1
96	457.1
97	271.4
98	285.7
99	342.9
100	542.9
Avg	313.1
SD	135.5

Table B5 Degree of splashing of stainless steel arc wire (316L) splats.

Splat number	Perimeter	Area	Degree of splashing
1	1333.17	2128.00	66.50
2	1902.23	6084.00	47.35
3	1187.54	3125.00	35.93
4	819.60	2014.00	26.56
5	729.99	12072.00	3.51
6	3012.57	13376.00	54.02
7	922.21	2254.00	30.04
8	2004.44	6298.00	50.79
9	595.20	2372.00	11.89
10	902.38	11406.00	5.68
11	932.06	3316.00	20.86
12	1253.47	4528.00	27.63
13	474.25	14654.00	1.22

Table B5 (continued) Degree of splashing of stainless steel arc wire (316L) splats.

Splat number	Perimeter	Area	Degree of splashing
14	496.79	8334.00	2.36
15	658.54	15300.00	2.26
16	2028.49	26317.00	12.45
17	1430.31	40968.00	3.98
18	421.76	7020.00	2.02
19	292.27	4194.00	1.62
20	1460.05	6256.00	27.13
21	524.76	1846.00	11.88
22	1377.69	5594.00	27.01
23	717.11	9248.00	4.43
24	588.73	9820.00	2.81
25	671.35	4130.00	8.69
26	547.21	11726.00	2.03
27	212.80	3313.00	1.09
28	154.57	1804.00	1.05
29	114.76	1200.00	0.87
30	1697.06	22436.00	10.22
31	651.90	13166.00	2.57
32	321.12	4838.00	1.70
33	1470.45	33810.00	5.09
34	237.92	3961.00	1.14
35	355.31	6765.00	1.49
36	1511.77	23102.00	7.88
37	350.49	9148.00	1.07
38	165.06	2032.00	1.07
39	279.17	4666.00	1.33
40	326.96	6651.00	1.28
41	918.47	1524.00	44.07
42	975.16	17326.00	4.37
43	1758.73	33110.00	7.44
44	834.65	4948.00	11.21
45	843.18	6224.00	9.09
46	515.44	3568.00	5.93
47	523.77	2168.00	10.07
48	183.32	492.00	5.44
49	260.60	1220.00	4.43
50	807.20	3072.00	16.89
51	1333.17	2128.00	66.50
52	1902.23	6084.00	47.35
53	1187.54	3125.00	35.93
54	819.60	2014.00	26.56
55	729.99	12072.00	3.51

Table B5 (continued) Degree of splashing of stainless steel arc wire (316L) splats.

Splat number	Perimeter	Area	Degree of splashing
56	3012.57	13376.00	54.02
57	922.21	2254.00	30.04
58	2004.44	6298.00	50.79
59	595.20	2372.00	11.89
60	902.38	11406.00	5.68
61	932.06	3316.00	20.86
62	1253.47	4528.00	27.63
63	474.25	14654.00	1.22
64	496.79	8334.00	2.36
65	658.54	15300.00	2.26
66	2028.49	26317.00	12.45
67	1430.31	40968.00	3.98
68	421.76	7020.00	2.02
69	292.27	4194.00	1.62
70	1460.05	6256.00	27.13
71	524.76	1846.00	11.88
72	1377.69	5594.00	27.01
73	717.11	9248.00	4.43
74	588.73	9820.00	2.81
75	671.35	4130.00	8.69
76	547.21	11726.00	2.03
77	212.80	3313.00	1.09
78	154.57	1804.00	1.05
79	114.76	1200.00	0.87
80	1697.06	22436.00	10.22
81	651.90	13166.00	2.57
82	321.12	4838.00	1.70
83	1470.45	33810.00	5.09
84	237.92	3961.00	1.14
85	355.31	6765.00	1.49
86	1511.77	23102.00	7.88
87	350.49	9148.00	1.07
88	165.06	2032.00	1.07
89	279.17	4666.00	1.33
90	326.96	6651.00	1.28
91	918.47	1524.00	44.07
92	975.16	17326.00	4.37
93	1758.73	33110.00	7.44
94	834.65	4948.00	11.21
95	843.18	6224.00	9.09

Table B5 (continued) Degree of splashing of stainless steel arc wire (316L) splats.

Splat number	Perimeter	Area	Degree of splashing
96	515.44	3568.00	5.93
97	523.77	2168.00	10.07
98	183.32	492.00	5.44
99	260.60	1220.00	4.43
100	807.20	3072.00	16.89
Avg	-	-	12.9
SD	-	-	6.1

Table B6 Distribution of the stainless steel arc wire (316L) degree of splashing.

Size (μm)	Number of in-flight particle
0-10	62
10-20	14
20-30	10
30-40	4
40-50	4
50-60	4
60-70	2

Table B7 Coating thickness of stainless steel arc wire (316L) coating.

Location number	Thickness (μm)
1	218
2	224
3	212
4	224
5	212
6	218
7	212
8	224
9	224
10	224
11	212
12	206
13	206
14	224
15	224
16	224
17	218
18	229
19	224
20	212
21	210
22	211
23	212
24	224
25	206
26	229
27	212
28	224
29	226
30	224
Avg	218.29
SD	7.14

Table B8 Roughness of stainless steel arc wire (316L) coatings.

Location number	Roughness (μm)
1	8.8
2	8.8
3	10.6
4	8.8
5	9.8
6	10.0
7	9.8
8	9.6
9	12.2
10	10.2
11	10.8
12	11.0
13	11.2
14	10.2
15	11.0
Avg	10.2
SD	0.6

Table B 9 Percentage of porosity and oxide of stainless steel arc wire (316L) coatings.

Location number	Percentage of porosity (%)	Percentage of oxide (%)
1	0.12	34.66
2	0.52	34.52
3	0.39	33.48
4	0.48	35.39
5	0.19	33.54
6	0.32	34.85
7	0.24	34.38
8	0.20	35.66
9	0.09	34.49
10	0.19	36.02
Avg	0.25	34.38
SD	0.13	0.86

Table B10 Hardness of stainless steel (316L) arc wire [48].

Location Number	Hardness (μm)
1	407.9
2	418.6
3	414.2
4	415.2
5	420.6
6	423.1
7	418.3
8	387.2
9	394.1
10	382.1
Avg	408.1
SD	14.9

Table B11 Hardness of stainless steel arc wire (316L) coating.

Location Number	Hardness (μm)
1	380.8
2	318.1
3	381.0
4	367.8
5	375.5
6	358.3
7	377.1
8	368.0
9	339.7
10	367.7
Avg	364.3
SD	20.5

Table B12 Abrasive wear of the stainless steel arc wire (316L) coating by dry sand rubber wheel.

Distance (m)	Sample mass (g)	Mass loss (g)
0	27.5709	0
50	27.5420	28.9
100	27.5175	53.4
150	27.4960	74.9
200	27.4702	100.7
250	27.4476	123.3

Table B13 Sliding wear of the stainless steel arc wire (316L) coating by pin on disk.

No	Track wide (μm)			
	50 (m)	75 (m)	100 (m)	125 (m)
1	353.0	346.0	334.2	347.2
2	357.3	350.3	335.0	353.2
3	315.3	309.5	326.4	315.0
4	324.0	320.0	329.2	335.0
Avg	337.4	331.6	331.2	337.6

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