ARUN TECHNOLOGY

APPLICATION NOTE

316 AND 316L STAINLESS STEEL

The precision of carbon analysis for 316 and 316L stainless steel samples is very important because of how much their properties differ.

Grade 316L is immune from sensitisation, the precipitation of carbides at grade boundaries. Because of this it is extensively used in heavy gauge welded components over 6mm in size. 316L also offers higher tensile strength at elevated temperature.

Both 316 and 316L grades have excellent toughness, even down to cryogenic temperatures. Molybdenum gives both grades better corrosion resistance that grade 304, particularly higher resistance to pitting and crevice corrosion in chloride environments.

316 AND 316L COMPOSITION SPECIFICATION

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N
316	**Min**						16.0	2.0	10.0	
	Max	**0.08**	2.0	0.75	0.045	0.03	18.0	3.0	14.0	0.1
316L	**Min**						16.0	2.0	10.0	
	Max	**0.03**	2.0	0.75	0.045	0.03	18.0	3.0	14.0	0.1

316 ANALYSIS RESULTS USING ARTUS 8 ULTIMATE

Analysis performed using a production ARTUS 8 Ultimate instrument to test CRM SS466-1.

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu
Run 1	0.0613	0.499	0.707	0.0196	0.0140	17.54	2.18	8.61	0.0094	0.0033	0.0161	0.0221
Run 2	0.0623	0.504	0.700	0.0193	0.0162	17.62	2.21	8.64	0.0092	0.0033	0.0126	0.0246
Run 3	0.0625	0.499	0.703	0.0191	0.0163	17.57	2.22	8.60	0.0093	0.0032	0.0148	0.0296
Run 4	0.0625	0.495	0.701	0.0199	0.0165	17.63	2.20	8.65	0.0102	0.0033	0.0137	0.0249
Run 5	0.0609	0.501	0.702	0.0207	0.0164	17.58	2.22	8.63	0.0105	0.0032	0.0138	0.0280
Run 6	0.0630	0.505	0.704	0.0196	0.0161	17.59	2.23	8.63	0.0106	0.0032	0.0131	0.0255
Run 7	0.0619	0.503	0.700	0.0191	0.0160	17.66	2.20	8.58	0.0105	0.0033	0.0143	0.0268
Average	0.0621	0.501	0.703	0.0196	0.0159	17.60	2.21	8.62	0.01	0.0033	0.0141	0.0259
Certified Value	0.062	0.505	0.698	0.02	0.016	17.65	2.19	8.61				
SD	0.0007	0.0034	0.0025	0.0006	0.001	0.0403	0.0172	0.025	0.0006	0.0001	0.0011	0.0025

	Nb	As	Sn	Ti	V	W	Ca	Pb	Zn	Sb	Bi	N
Run 1	0.0242	<0.001	0.0062	0.0021	0.0217	<0.02	0.0011	<0.002	<0.0045	0.0045	<0.0005	0.0499
Run 2	0.0232	<0.001	0.0049	0.0020	0.0209	<0.02	0.0013	<0.002	<0.0045	0.0053	<0.0005	0.0371
Run 3	0.0218	<0.001	0.0051	0.0020	0.0212	<0.02	0.0012	<0.002	<0.0045	0.0049	<0.0005	0.0649
Run 4	0.0229	<0.001	0.0053	0.0025	0.0213	<0.02	0.0012	<0.002	<0.0045	0.0055	<0.0005	0.0396
Run 5	0.0234	<0.001	0.0052	0.0019	0.0210	<0.02	0.0013	<0.002	<0.0045	0.0045	<0.0005	0.0380
Run 6	0.0235	<0.001	0.0051	0.0021	0.0206	<0.02	0.0017	<0.002	<0.0045	0.0052	<0.0005	0.0524
Run 7	0.0227	<0.001	0.0055	0.0026	0.0210	<0.02	0.0014	<0.002	<0.0045	0.0058	<0.0005	0.0259
Average	0.0231	<0.001	0.0053	0.0022	0.0211	<0.02	0.0013	<0.002	<0.0045	0.0051	<0.0005	0.044
Certified Value	0.029		0.005					0.0014				
SD	0.0007		0.0004	0.0003	0.0004		0.0002			0.0005		0.0127

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APPLICATION NOTE

316 AND 316L STAINLESS STEEL

316L ANALYSIS RESULTS USING ARTUS 8 ULTIMATE

Analysis performed using a production ARTUS 8 Ultimate instrument to test CRM BS84J.

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu
Run 1	0.0185	0.568	1.47	0.0337	0.0236	17.11	2.08	10.41	0.0051	0.0011	0.230	0.466
Run 2	0.0167	0.566	1.47	0.0320	0.0244	17.17	2.06	10.37	0.0075	0.0012	0.228	0.472
Run 3	0.0162	0.575	1.47	0.0341	0.0281	17.23	2.09	10.39	0.0047	0.0012	0.229	0.455
Run 4	0.0166	0.587	1.48	0.0363	0.0313	17.14	2.11	10.35	0.0047	0.0013	0.231	0.462
Run 5	0.0170	0.567	1.45	0.0346	0.0247	17.13	2.08	10.25	0.0052	0.0011	0.230	0.456
Average	0.017	0.573	1.47	0.0341	0.0264	17.16	2.08	10.35	0.0055	0.0012	0.230	0.462
Certified Value	0.017	0.57	1.46	0.035	0.025	17.12	2.08	10.34			0.23	0.46
SD	0.0009	0.0087	0.0109	0.0015	0.0032	0.0461	0.0181	0.0624	0.0012	0.0001	0.0009	0.007

	Nb	As	Sn	Ti	V	W	Ca	Pb	Zn	Sb	Bi	N
Run 1	0.0271	<0.001	0.0078	0.00083	0.0899	0.0540	0.0010	<0.002	<0.0045	<0.002	<0.0005	0.0662
Run 2	0.0221	<0.001	0.0075	0.00083	0.0894	0.0519	0.0011	<0.002	<0.0045	<0.002	<0.0005	0.0677
Run 3	0.0254	<0.001	0.0074	0.00100	0.0904	0.0536	0.0011	<0.002	<0.0045	<0.002	<0.0005	0.0697
Run 4	0.0284	<0.001	0.0076	0.00050	0.0916	0.0526	0.0011	<0.002	<0.0045	<0.002	<0.0005	0.0744
Run 5	0.0243	<0.001	0.0074	0.00083	0.0906	0.0544	0.0012	<0.002	<0.0045	<0.002	<0.0005	0.0580
Average	0.0255	<0.001	0.0075	0.00081	0.0904	0.0533	0.0011	<0.002	<0.0045	<0.002	<0.0005	0.0671
Certified Value	0.024		0.007		0.09	0.054	0.001					
SD	0.0024		0.0001	0.0002	0.0008	0.001	0.0001					0.0059

Comparing the results from the ARTUS 8 Ultimate with the certificate values for SS466-1 and BS84J, it is clear that the results are accurate. Standard deviation values are small, meaning that the precision of analyses carried out with the ARTUS 8 Ultimate is good enough to reliably identify the different carbon levels in 316 and 316L samples.

APPLICATIONS FOR AUSTENITIC STAINLESS STEEL

- Automotive trim
- Cookware
- Food and beverage equipment
- Industrial equipment
- Marine applications
- Medical implants