Analytical Reference Materials International

Certificate of Analysis
Certified Reference Material

Grade: **Nickel 200 / UNS N02200**

Part Number (Q.A. NO.): **IARM 50B**

Certificate Date: **09/29/1999** Certificate No.: **50B-09291999-IARM-F** Revision Date: **03/19/2003**

Interpretation of Data

1. Certified values listed below reflect analysis results submitted by qualified analytical laboratories using a combination of methods and instrumentation that emulate actual methods and instrumental techniques currently utilized in the analytical community.
2. Any data reported and enclosed by a **parentheses ( ) is a "best estimate" and is NOT CERTIFIED.** This data could not be quantified sufficiently for certification. It was however, reported by enough laboratories to be considered as potentially present in the matrix of the material being examined.
3. The "Inter-laboratory Analysis Program" (ILAP) utilized in the establishment of the data are an ongoing program with permanent membership. Certain elements may be selected by a consensus of the members for more extensive testing. Therefore the data in **brackets [ ] indicates further testing is in process.**
4. The **"± Confidence Interval at 95%"** is enclosed by a **parentheses ( ) below the individual element's concentration.**

IMPORTANT: **A "User Registration Card" accompanies all shipments. This card should be completed immediately upon receipt of materials with the appropriate user information. This is the only way in which ARMI can guarantee customer updates or possible data modifications!**

Aluminum	Boron	Carbon	Cobalt	Chromium	Copper	Iron	Magnesium
0.031	(0.0002)	0.010	0.069	0.010	(0.001)	0.079	(0.001)
(0.003)		(0.001)	(0.003)	(0.001)		(0.005)	

Manganese	Molybdenum	Nitrogen	Niobium	Nickel	Oxygen	Phosphorus	Sulfur
0.20	(0.003)	0.0001	(0.002)	99.5	0.0061	0.002	0.0002
(0.01)		(0.00004)		(0.1)	(0.0003)	(0.0005)	(0.0001)

Silicon	Tantalum	Tin	Titanium	Vanadium	Tungsten	Zirconium
0.059	<0.005	<0.001	0.002	0.016	0.010	(0.001)
(0.006)			(0.0007)	(0.002)	(0.003)	

The laboratories participating in the "Inter-Laboratory Analysis Program" (ILAP) and certification of this material are as follows:

Allvac - Monroe, NC
Allvac Lockport - Lockport, NY
Anderson Laboratories, Inc. - Greendale, WI
AvestaPolarit Stainless OY - Tornio Finland
Colonial Metals Co. - Chicago, IL
Deloro Stellite - Belleville, Ontario, Canada
Haynes International, Inc. - Kokomo, IN
Howmet Dover Alloy - Dover, NJ
Laboratory Testing, Inc. - Hatfield, PA
Howmet Research Center - Whitehall, MI
Laboratory Testing, Inc. - Hatfield, PA
Special Metals Corporation - Huntington, WV
Special Metals Wiggin LTD. - Hereford, England

Traceability: All members of the "Inter-Laboratory Analysis Program" (ILAP) listed above validate test methods and instrument performance utilizing SRMs produced by the National Institute of Standards and Technology, (NIST) as well as other CRMs and RMs produced by recognized Certifying Bodies from around the world. The specific SRMs, CRMs and RMs applicable to the material covered by this certificate are: NIST C1251, 1159, 1160, 1186, 1187, 1188, 1190, 1191, 1192, 1193, 1195, 1197, 1198, 1201, 1203, 1204, 1205, 1206/2, 1207/1, 1207/2, 1208/1, 1208/2, 1243, 1244, 1245A, 1247, 1271, 1762, 131F, 367, 337, 6G, LECO 501-502, 501-550, 502-256, 501-644, 502-016, 502- Al, HAS 400M, 400T, 600C, 600T, 750A, 750C, 750F, NIST 1243, 1199, 1200, HAS 188A, 4005A, 200P, 750F, U 3933, 3934, LECO 501-503, 501-551, 502-102, BCS 351, 454/1, 462/1, SPEX 8-49Al-X, 8-5B, 7-156Co, 7-107Cr, 7-140Cu, 7-97Fe, 7-62Mg, 7-116Mn, 7-65Mo, 7-96Nb, 7-139Ni, 7-120P, 8-27Si-A-X, 7-115Ti, 7-135V, 6-266W, 7-85Zr, 7-67Ag, 7-50As, 7-148Bi, 7-86Ca, 7-52La, 6-244Pb, 7-102Sb, 7-50Se, 7-68Sn, 7-122Ta, 7-66Y, 6-264Zn, LECO 501-505, 501-645, ALPHA AR556, NIST 121D, 3101A, 3107, 3113, 3112A, 3114, 3126A, 3131A, 3132, 3134, 3137, 3139A, 3150, 3162A, 3165, 3163, 3169, 3105A, 3127A, 3128, 3149, 3168A, 3152A, LECO 501-643, NIST 16F, 123B, 132B, 134A, 135, 155, 160B, 168, 173B343A, 348A, 349A, 361, 363, 364, 367, 661, 1187, 1208-1, 1254, 1765, 2165, C2402, 2423, 2424A, 2425A, 3167, HAYNES 718, H5, LECO 501-553, 502-016, NIST 1208, IARM 50A, 53A, 63A, FX B605, N276, WILLAN 6001-C, 6002-B, RN10-1, DI 5760, 4076, BS 600-B, MBH 7181-G, AL 912836, 11236D, LECO 502-193, 502-194, NIST 3107, 3131A, BS 200-2, CSN-4, LECO 501-504, 501-676, 501-644, 501-643, 501-646, 501-502, 501-674, IARM 50A, BS 200-1

A specific line of traceability is established to NIST and other Certifying Bodies for those elements that are noted as "Certified Values" on the Certificates of Analyses referenced above.

See Reverse Side for Statistical Data and Additional Information Regarding this Material.

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The following data and accompanying statements represent all pertinent information reported in the ILAP as it applies to the chemical characterization of this material as of 03/19/2003.

50B	Al	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	N	Nb	Ni	O	P	S	Si
1	0.036	<0.0002	0.010	0.071	0.009	<0.005	0.080	0.002	0.203	<0.001	0.0002	<0.001	99.52	0.0060	0.0015	0.0001	0.051
2	0.0257	<0.0020	0.0080	0.072	0.0112	<0.001	0.0725	0.0039	0.1989	0.0037	0.0001	0.0013	99.2	0.0066	0.001	0.0001	0.0548
3	0.033	0.0001	0.0087	0.073	0.010	0.0033	0.082	<0.0020	0.21	0.01	0.0001	<0.01	99.45	0.0055	0.001	0.0003	0.065
4	0.031	0.0001	0.010	0.064	0.009	0.008	0.068	0.00016	0.208	0.0018	0.0001	0.005	99.49	0.0058	0.002	0.0003	0.054
5	0.033	0.00003	0.0088	0.063	0.011	0.0007	0.079	0.0020	0.189	0.002	0.00005	0.001	99.75	0.0057	0.0026	0.00037	0.053
6	0.0298	0.0010	0.010	0.0626	0.010	<0.001	0.075	0.0022	0.201	0.0067	0.0001	0.00020	99.40	0.0066	0.0014	0.000045	0.065
7	0.029	0.0006	0.011	0.072	0.0093	0.00028	0.0873	0.0001	0.1861	0.0100	0.00013	0.0100	99.77	0.0066	0.0027	0.0004	0.0676
8	0.0237	<0.0003	0.010	0.070	0.010	0.0004	0.083	0.0001	0.197	0.0018		0.0031	99.387	0.0064	0.0016	0.0002	
9	0.038	0.0002	0.0129	0.0717	0.011	0.0003	0.088	0.0012	0.21	<0.001		0.001	99.562	0.00596		0.0003	
10	0.0291	<0.0001	0.0095		0.009	0.002		0.0007	0.1924	0.002		0.0005				0.00026	
11			0.009		0.0086	0.0008		0.0016		0.006		0.002					
12			0.01050			<0.001				<0.0001		0.003					
13			0.0119			<0.001						<0.0010					
14						0.0034											
Mean	0.0308	0.0003	0.0100	0.0688	0.0098	0.0021	0.0794	0.0014	0.1995	0.0049	0.0001	0.0027	99.5054	0.0061	0.0017	0.0002	0.0586
STDV.	0.0044	0.0004	0.0013	0.0043	0.0009	0.0025	0.0066	0.0012	0.0085	0.0034	0.0000	0.0029	0.1743	0.0004	0.0007	0.0001	0.0069
Certified	**0.031**	**(0.0002)**	**0.010**	**0.069**	**0.010**	**(0.001)**	**0.079**	**(0.001)**	**0.20**	**(0.003)**	**0.0001**	**(0.002)**	**99.5**	**0.0061**	**0.002**	**0.0002**	**0.059**
95% C.I.	**0.003**		**0.001**	**0.003**	**0.001**		**0.005**		**0.01**		**0.00004**		**0.1**	**0.0003**	**0.0005**	**0.0001**	**0.006**
Methods	X,A,I,O	G,D,I,O	C,O	X,G,A,I,O	X,G,A,I,O	X,G,D,I,O	X,G,I,O	X,G,D,A,I,O	X,A,I,O	X,G,D,I,O	F	X,G,D,I,O	X,W,I,O	F	X,D,I,O	C,G,O	X,A,I,O

LEGEND: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G = GDMS, H = Hollow Cathode OE

50B	Ti	V	W	Zr	Ag	As	Bi	Ca	H	La	Pb	Sb	Se	Sn	Ta	Y	Zn
1	0.001	0.017	0.014	<0.01	<0.0001	<0.01	<0.001	0.0007	0.00016	<0.00001	<0.0001	<0.01	<0.0001	<0.01	0.0001	<0.005	0.0001
2	0.0026	0.014	0.008	0.0002	<0.0002	<0.0001	<0.0001	0.00005	0.0004	<0.001	0.0002	<0.00001	<0.00001	0.0002	<0.010	<0.00001	0.0001
3	0.002	0.016	0.0100	<0.010	<0.00001	<0.00001	<0.00001	<0.00001		<0.0001	<0.0005	0.0006	<0.00001	<0.0030	0.001	<0.001	0.00005
4	0.00090	0.0157	0.007	0.0004	<0.0001	<0.00001	<0.0001				<0.00001	<0.000002	0.0027	0.00006	0.008		0.0002
5	0.001	0.015	0.011	<0.001	0.00001		<0.000005				<0.0001	<0.00001		0.0001	0.00001		<0.0001
6	0.0008	0.019	0.0100	0.00001	<0.00001		<0.00001				<0.000005			<0.00002	0.0100		
7	0.001	0.018		0.0100							<0.00001			0.0003	<0.0001		
8	0.003			0.0002							<0.0001			0.0011	0.003		
9				0.0031							0.0001			0.0004	0.0013		
10				0.003							0.0009			0.0043	<0.0001		
11				<0.0002										<0.0001	0.0071		
Mean	0.0015	0.0164	0.0100	0.0024	0.0000	#DIV/0!	#DIV/0!	0.0004	0.0003	#DIV/0!	0.0004	0.0006	0.0027	0.0009	0.0038	#DIV/0!	0.0001
STDV.	0.0009	0.0017	0.0024	0.0036	#DIV/0!	#DIV/0!	#DIV/0!	0.0005	0.0002	#DIV/0!	0.0004	#DIV/0!	#DIV/0!	0.0015	0.0040	#DIV/0!	0.0001
Certified	**0.002**	**0.016**	**0.010**	**(0.001)**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0005**			**<0.0001**	**<0.0005**	**<0.0001**	**<0.001**	**<0.005**		**<0.0001**
95% C.I.	**0.0007**	**0.002**	**0.003**														
Methods	X,G,D,I,O	X,I,O	X,I,O	X,G,D,I,O	G,DA,I,O	G,D,A,O	G,DA,I,O	G,A,O			G,DA,I,O	D,I,A,O	G,A,I,O	G,DA,I,O	X,G,I,O		G,A,I,O

LEGEND: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G = GDMS, H = Hollow Cathode OE

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1981-(E) list the following:

Certifying Body: A technically competent body (organization or firm, public or private) that issues a Reference Material Certificate. The only generally accepted certifying body in the United States is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD.

Reference Material (RM): A material or substance with one or more properties which are sufficiently well established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): A reference material with one or more properties whose values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation, which is issued by a Certifying Body.

Inter-Laboratory Analysis Program (ILAP): Although ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", it is also a well thought out and logical plan for conducting an inter-laboratory program involving multiple techniques. Therefore, the planning, conducting, analyzing, protocol and treatment of data resulting from this inter-laboratory program were performed utilizing the guidelines established in ASTM E691-87.

Methods of Analysis: In view of the fact, that the "Inter-Laboratory Analysis Program" entails a wide variety of materials, no single analytical method would provide optimum data results. Therefore, the methods utilized were a combination of ASTM Standard Methods for classical wet chemistry, ICP, AA, Optical Emission and X-Ray spectrometric methods. The determinations for Carbon, Sulfur, Nitrogen and Oxygen are the result of combustion instrument procedures.

Selection of Materials: A **"batch"** or **"series"** is defined as a single bar of one continuous length. The majority of materials are in wrought condition. Other methods of manufacture are utilized as a last resort, only in the case of those materials being unavailable in wrought condition. "Batch" samples are taken by removing a one-inch cross section for every thirteen inches of total length from the entire bar. Twenty-five percent of the one inch cross section is converted to chips for analysis by classical wet chemistry, ICP, AA, and combustion procedures and seventy-five percent remains in a solid disk form for OES and X-Ray analysis where applicable. Each member of the ILAP is furnished both a solid sample and the corresponding supply of chips from a specific location on the batch bar. This massive sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data.

Certified by: 

William D. Britt, President & General Manager
Analytical Reference Materials International Corporation

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Revision Date/No.: 03/19/2003