Certificate of Analysis
IARM Fe174PH-18
Stainless Steel 17-4PH / UNS S17400
Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.007 ± 0.002	**C**	0.041 ± 0.002	**Co**	0.047 ± 0.001	**Cr**	15.10 ± 0.04
Cu	3.33 ± 0.04	**Mn**	0.47 ± 0.01	**Mo**	0.315 ± 0.004	**N**	0.0436 ± 0.0008
Nb	0.285 ± 0.006	**Ni**	4.73 ± 0.05	**O**	0.0035 ± 0.0008	**P**	0.024 ± 0.003
Si	0.52 ± 0.01	**Sn**	0.008 ± 0.001	**V**	0.051 ± 0.002	**W**	0.015 ± 0.004

Indicative Values listed in ppm

As (<100)	B (<50)	Bi (<60)	Ca (<50)	Cd (<50)	Fe (75.1%)	H (<10)
Hf (<10)	Mg (<60)	Pb (<50)	Pd (<10)	S (<40)	Sb (<100)	Se (<50)
Ta (3)	Ti (<60)	Y (<10)	Zn (<50)	Zr (<30)		

Description and Intended Use

This **Certified Reference Material** is covered under the scope of accreditation to **ISO 17034** by LGC Standards - Manchester, NH. As an ISO 17034 certified reference material, appropriate use of this material will fulfill the certified reference material and traceability requirements for use in **ISO 17025** certified laboratories. This CRM may come in the form of a solid disk, chips, or powder. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods.

Instructions for Use

1. The test surface is on the opposite side of the labeled surface, which includes the material identification. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. Each packaged disk has been prepared by finishing the test surface using a lathe. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing, as these processes may contaminate the surface.
2. The minimum sample size for chips should be individually evaluated based on the analytical technique used; this would typically be greater than 0.1 grams.
3. The material should be stored in a cool, dry location when not in use.
4. Chips are not recommended for gas analysis.

The following data represents all pertinent information reported as it applies to the chemical characterization of this material.

	Al	C	Co	Cr	Cu	Mn	Mo	N	Nb	Ni	O	P	Si	Sn	V	W
1	0.0032	0.0381	0.04277	14.96	3.218	0.437	0.30633	0.04212	0.272	4.62	0.00248	0.018	0.486	0.00391	0.047	0.0117
2	0.005	0.0395	0.045	15.02	3.266	0.444	0.308	0.043	0.272	4.65	0.0025	0.02073	0.513	0.008	0.048	0.012
3	0.0052	0.04	0.047	15.049	3.27	0.4481	0.3092	0.043	0.278	4.6567	0.00262	0.021	0.514	0.008	0.048	0.012
4	0.0054	0.04	0.047	15.08	3.3033	0.451	0.31	0.0433	0.278	4.6604	0.00297	0.02107	0.516	0.008	0.0496	0.0126
5	0.0078	0.0407	0.0472	15.093	3.311	0.4553	0.31	0.04341	0.279	4.698	0.0036	0.022	0.5186	0.00813	0.0498	0.013
6	0.0088	0.041	0.0473	15.0967	3.315	0.46	0.312	0.044	0.281	4.705	0.004	0.0228	0.52	0.0085	0.0499	0.015
7	0.009	0.0418	0.0474	15.101	3.32	0.463	0.313	0.04493	0.284	4.7233	0.0046	0.023	0.525	0.009	0.05008	0.0154
8	0.011	0.0424	0.048	15.11	3.323	0.466	0.314	0.0451	0.28433	4.728	0.00503	0.025	0.52667	0.0097	0.051	0.025
9		0.04404	0.0489	15.1105	3.34	0.4721	0.3167		0.289	4.767		0.02525	0.529		0.051	
10		0.047	0.049	15.12	3.342	0.47977	0.32143		0.298	4.78		0.02577	0.54		0.051	
11			0.0497	15.1221	3.3656	0.4853	0.324		0.299	4.8067		0.027	0.5401		0.05317	
12			0.04975	15.13	3.45	0.497	0.3268		0.30	4.82		0.028	0.54767		0.0534	
13				15.28	3.496	0.503	0.328			4.925		0.0323			0.059	
14																
Mean	0.007	0.041	0.047	15.1	3.33	0.47	0.315	0.0436	0.285	4.73	0.0035	0.024	0.52	0.008	0.051	0.015
STDV.	0.003	0.003	0.002	0.07	0.07	0.02	0.007	0.001	0.01	0.08	0.001	0.004	0.02	0.002	0.003	0.004
Certified	**0.007**	**0.041**	**0.047**	**15.10**	**3.33**	**0.47**	**0.315**	**0.0436**	**0.285**	**4.73**	**0.0035**	**0.024**	**0.52**	**0.008**	**0.051**	**0.015**
U_{CRM}	0.002	0.002	0.001	0.04	0.04	0.01	0.004	0.0008	0.006	0.05	0.0008	0.003	0.01	0.001	0.002	0.004
Methods	IM,I,O	C	IM,I,O,X	I,O,X	I,O,X	I,O,X	I,O,X	F	I,O,X	I,O,X	F	IM,I,O,X	I,O,X	IM,I,O	IM,I,O,X	IM,I,X,O

	As	B	Bi	Ca	Cd	Fe	H	Hf	Mg	Pb	Pd	S	Sb	Se	Ta	Ti
1	0.00463	0.001	0.006	0.001	0.0004767	74.833	0.00015	<0.001	0.0004	0.0002	<0.001	0.000067	0.00099	0.0020	0.00024	0.0010
2	0.0059	0.0025	<0.00005	0.00223	<0.0005	75.067	0.000167		0.006	0.00022		0.0003	0.001	<0.001	0.00034	0.001
3	0.01	0.0025	<0.001	<0.0005	<0.001	75.103	0.00042		<0.001	0.00391		0.0003	0.0012	<0.001	<0.001	0.0015
4	<0.001	0.00284	<0.001	<0.001	<0.001	75.1605	<0.0001		<0.001	<0.001		0.00053	0.005	<0.005	<0.001	0.006
5	<0.005	0.003	<0.005	<0.005	<0.001	75.29	<0.001		<0.001	<0.001		0.00060	0.0108		<0.001	<0.001
6		<0.001		<0.005	<0.005	75.30			<0.005			0.0006			<0.005	<0.005
7	<0.005											0.0007				
8												0.0029				
9												0.00332				
10												<0.0005				
11												<0.001				
Mean	0.007	0.0020		0.0020		75.1				0.001		0.001	0.004		0.00030	0.003
STDV.	0.003	0.0008		0.0009		0.2				0.002		0.001	0.004		0.00007	0.003
	(<0.01)	**(<0.005)**	**(<0.006)**	**(<0.005)**	**(<0.005)**	**75.1**	**(<0.001)**	**(<0.001)**	**(<0.006)**	**(<0.005)**	**(<0.001)**	**(<0.004)**	**(<0.01)**	**(<0.005)**	**(0.0003)**	**(<0.006)**
Methods	IM,I	IM,I	IM,I	IM,I	IM,I	I,O,X	F	IM	IM,I,O	IM,I	IM	C,X,O	IM,I	IM,I	IM,I	IM,I,O

	Y	Zn	Zr
1	<0.001	0.00038	0.00005
2		<0.001	0.00006
3		<0.001	0.0029
4		<0.001	<0.001
5		<0.005	<0.001
Mean			0.001
STDV.			0.002
	(<0.001)	**(<0.005)**	**(<0.003)**
Methods	IM	IM,I,O	IM,I

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

Certification Laboratories

Applied Technical Services, Inc.	Marietta, GA	Connecticut Metallurgical, Inc.	East Hartford, CT
Dirats Laboratories	Westfield, MA	EAG Laboratories, Inc.	Liverpool, NY
Element Materials Technology	Gary, IN	IMR Test Labs	Lansing, NY
Massachusetts Materials Research, Inc.	West Boylston, MA	NSL Analytical Services, Inc.	Cleveland, OH
SGS MSi	Melrose Park, IL	LGC Standards	Manchester, NH

Certification laboratories have demonstrated performance and traceability by utilizing a variety of test methods all under the scope of ISO 17025. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

IARM 111A   IARM 153B   IARM 22B   IARM 23B   IARM 56A   IARM6D   NBS 184   NBS 345   NBS 856   NBS 37e

Homogeneity and Uncertainty

"Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental XRF results are reflected in both the overall statistics and certified data. Homogeneity samples are selected by a systematic sampling procedure. The number of samples may be determined by equation 1, where N_{prod} is the number of units produced and N_{min} is the number of samples used for homogeneity testing. These samples are arranged in a simple randomized design such that each sample is analyzed multiple times by XRF. Homogeneity may also be determined within sample using an applied version of ASTM E826. A single factor ANOVA is used to calculated uncertainty due to inhomogeneity (U_{hom}). Uncertainty of the material is calculated by equation 2, where H=U_{hom}, S= Standard deviation, t= t-value at 95% CI, and n= number of observations.

$$1. \quad N_{min} = \max(10, \sqrt[3]{N_{prod}})$$

$$2. \quad U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

Expiration

The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

David Coler, General Manager

Analytical Reference Materials International

ACCREDITED