

Bundesanstalt für Materialforschung und -prüfung (BAM)

Certified Reference Material

BAM-S013

Niobium carbide

Certified Values

Element	Mass fraction ¹⁾ in %	Uncertainty ²⁾ in %
C	10.66	0.07
O	0.307	0.013

¹⁾ Unweighted mean value of the means of accepted sets of data (consisting of at least 3 single results), each set being obtained by a different laboratory and/or a different method of measurement.

²⁾ Estimated expanded uncertainty U with a coverage factor of $k = 2$, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

Informative Values

Element	Mass fraction ¹⁾ in %	Uncertainty ²⁾ in %
C _{free}	0.10	0.04
N	0.0031	0.0009
S	0.0017	0.0005
H	0.0076	0.0007

¹⁾ Unweighted mean value of the means of accepted sets of data (consisting of at least 2 single results), each set being obtained by a different laboratory and/or a different method of measurement.

²⁾ Estimated expanded uncertainty U with a coverage factor of $k = 2$, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

Sample description

The Reference Material is available as powder. It is supplied in glass bottles containing 60 g.

Recommended Use

The reference material is intended for development, calibration, validation, and quality control of analytical methods for the determination of elements in samples of similar matrix composition. The minimum sample size for chemical analysis is 0.1 g.

Informative Values

Property	Property value ¹⁾	Uncertainty ²⁾
Specific surface area (BET)	1.04 m ² / g	0.03 m ² / g
Particle size:		
d ₁₀	1.10 μm	0.23 μm
d ₅₀	3.57 μm	0.18 μm
d ₉₀	6.7 μm	0.4 μm
<p>¹⁾ Values were not certified, but given for information, because there was no homogeneity and stability investigation.</p> <p>²⁾ Estimated expanded uncertainty <i>U</i> with a coverage factor of <i>k</i> = 3, corresponding to a level of confidence of approx. 99 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).</p>		

Transport and Storage

The material should be stored in a dry and clean environment at room temperature. Transport can be done under normal ambient conditions.

Instructions for Use

Before taking a sample, homogenization by manually shaking the closed bottle for 20 seconds is strongly recommended.

Participating Laboratories

Bruker AXS GmbH, Karlsruhe (Germany)
 Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)
 ChemiLytics GmbH & Co. KG, Goslar (Germany)
 Dorfner Analysenzentrum und Anlagenplanungsgesellschaft mbH (ANZAPLAN), Hirschau (Germany)
 Elementar Analysensysteme GmbH, Langenselbold (Germany)
 Forschungsinstitut für Anorganische Werkstoffe -Glas/Keramik- GmbH, Höhr-Grenzhausen (Germany)
 Fraunhofer-Institut für Keramische Technologien und Systeme IKTS, Hermsdorf (Germany)
 Horn & Co. Analytics GmbH, Wenden-Hünsborn, (Germany)
 Leibniz-Institut für Festkörper- und Werkstoffforschung (IFW), Dresden (Germany)
 Karlsruher Institut für Technologie (KIT), Eggenstein-Leopoldshafen (Germany)
 LECO Europe Application and Technology Center, Berlin (Germany)
 Plansee SE, Reutte (Austria)
 revierlabor, Essen (Germany)
 Treibacher Industrie AG, Treibach-Althofen (Austria)
 voestalpine Böhler Welding Germany GmbH, Hamm (Germany)

Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration was performed using standard solutions prepared from pure metals or stoichiometric compounds or with traceable commercial calibration solutions.

Means of Accepted Data Sets

Line No.	Certified values Mass fraction in %		Value for information				in μm			in m^2/g
	C	O	C _{frei}	N	S	H	d ₁₀	d ₅₀	d ₉₀	BET
1	10.43	0.267	0.0767	0.0012	0.0005	0.0060	0.618	3.297	6.020	---
2	10.57	0.289	0.0984	0.0018	0.0009	0.0075	0.828	3.357	6.250	1.010
3	10.57	0.290	0.1317	0.0020	0.0010	0.0076	0.867	3.367	6.483	1.020
4	10.58	0.295		0.0024	0.0011	0.0076	1.090	3.380	6.617	1.025
5	10.58	0.303		0.0025	0.0018	0.0078	1.130	3.588	6.710	1.039
6	10.59	0.307		0.0025	0.0020	0.0078	1.189	3.610	6.740	1.057
7	10.66	0.310		0.0028	0.0022	0.0084	1.194	3.640	6.851	1.070
8	10.67	0.315		0.0039	0.0025	0.0089	1.200	3.668	6.977	
9	10.70	0.316		0.0041	0.0025		1.213	3.675	7.020	
10	10.72	0.319		0.0041	0.0026		1.270	3.853	7.052	
11	10.74	0.329		0.0047			1.538	3.857	7.308	
12	10.75	0.343		0.0052						
13	10.79	---								
14	10.81									
<i>M</i>	10.66	0.307	0.1010	0.0031	0.0017	0.0077	1.103	3.572	6.730	1.037
<i>s_M</i>	0.11	0.021	0.0281	0.0013	0.0008	0.0009	0.250	0.197	0.375	0.023

The laboratory mean values have been examined statistically to eliminate outlying values. Where a " --- " appears in the table it indicates that an outlying value has been omitted. A data set consists of at least 2 single values of one laboratory.

M : mean of laboratory means

s_M : standard deviation of laboratory means

Technical Report

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify BAM-S013 is available on request or can be downloaded from BAM website (www.bam.de).

Accepted as BAM-CRM on 2022-12-01

Bundesanstalt für Materialforschung und -prüfung (BAM)



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