TAZ GMBH

Certificate

Certified Reference Material (CRM)

TAZ-048

high-alloy steel

Certified Values

Element	Mass fraction [1]	Uncertainty [2]	Unit [3]
C	0,105	0,006	%
Si	0,077	0,004	%
Mn	0,0452	0,0017	%
Cr	10,27	0,05	%
Ni	0,087	0,006	%
Mo	0,649	0,010	%
V	0,190	0,006	%
Cu	0,0332	0,0021	%
Al	0,0095	0,0008	%
W	1,72	0,07	%
Co	3,26	0,05	%
Sn	0,0024	0,0004	%
Nb	0,055	0,004	%
B	0,0019	0,0003	%
As	0,0028	0,0005	%
P	<0,005		%
S	<0,001		%
Ti	<0,002		%
Sb	<0,01		%

[1] Weighted mean values of the accepted data set mean values, whereby the data sets originate from different laboratories and were determined using different methods. The weighting was based on the reported measurement uncertainties.

[2] Expanded uncertainty U_{CRM} corresponding to a confidence level of 95 %.

[3] Although widely accepted in the industry, the “mass fraction in %” is neither an SI- nor an IUPAC-supported unit. Multiplying the certified values and uncertainties by 10^4 yields the values in µg/g.

This certificate is valid until February 2056.

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Description of the Material

The reference material is available in the form of rectangular cuboids with side lengths of approx. 42 mm and 36 mm a height of approx. 25 mm. The units are numbered consecutively from 01 to 12.

Intended Use

The reference material is intended for establishing and checking calibrations for X-ray fluorescence analysis, glow discharge and spark optical emission spectrometry for the analysis of samples of similar composition.

Instructions for Use

The entire surface opposite the engraving can be used for analysis. The surface of the sample to be analysed should not be used as delivered, but only after the surface has been prepared so that any protective layers are removed. Preparation should be carried out by turning, milling or grinding. At least three individual sparks should be used for an analysis.

Transport and Storage

The material must be stored in a dry and clean environment at room temperature. Transportation must be carried out under normal ambient conditions. The sample remains stable as long as it is not exposed to extreme heat (e.g. during surface treatment).

Homogeneity

A homogeneity assessment according to ASTM E826-14 and ISO 33405:2024 was carried out by TAZ GmbH using Spark-Optical Emission Spectrometry (OES) to determine the batch inhomogeneity.

Estimation of Uncertainty

The estimation of uncertainty takes into account the results of the homogeneity assessment and the characterization study. u_{hom} is obtained from the contributions of the homogeneity assessment between the units u_{bu} and within the units u_{wu}. u_{char} is the standard uncertainty of the characterization study, which results from the reported measurement uncertainties u_i and the resulting combined weighting factors w_i. u_{CRM} is the combined uncertainty of the homogeneity assessment and the characterisation study. The coverage factor is k = 2 and U_{CRM} is the expanded uncertainty. The reported uncertainties and the certified values have been rounded according to DIN 1333:1992.

$$u_{hom}=\sqrt{u_{bu}^2+u_{wu}^2} \qquad w_i=\frac{1}{u_i^2} \qquad u_{char}=\frac{1}{\sqrt{\sum w_i}} \qquad u_{CRM}=\sqrt{u_{char}^2+u_{hom}^2} \qquad U_{CRM}=k\cdot u_{CRM}$$

Metrological Traceability

The analytical values are traceable to the SI (Système International d'Unités) via calibration using pure metals, substances of known stoichiometry, certified reference materials or traceable standard solutions.

Laboratories involved in characterisation	Accreditation
FEM - Forschungsinstitut Edelmetalle + Metallchemie, Schwäbisch Gmünd, DE	DIN EN ISO/IEC 17025:2018-03
TAZ GmbH, Aichach, DE	DIN EN ISO/IEC 17025:2018-03
Thyssenkrupp Steel Europe AG, Duisburg, DE	DIN EN ISO/IEC 17025:2018-03

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Mean values of accepted data sets

	C		Si		Mn		P		S		Cr		Ni		Mo		V		Cu		Al		Ti	
No.	%	M	%	M	%	M	%	M	%	M	%	M	%	M	%	M	%	M	%	M	%	M	%	M
1	0,104	c	0,074	a	0,044	b	---	a	0,00043	a	10,18	b	0,076	d	0,636	a	0,183	a	0,030	a	0,0095	b	---	a
2	0,104	c	0,074	b	0,045	b	0,0031	b	<0,0006	c	10,20	a	0,085	a	0,642	a	0,189	a	0,031	b	<0,010	d	0,0004	a
3	0,108	c	0,078	d	0,046	a	0,0031	a	0,0009	a	10,26	a	0,085	b	0,647	b	0,194	d	0,033	d	0,0105	a	<0,002	b
4	0,111	a	0,079	a	0,048	d	<0,005	b	<0,001	c	10,27	d	0,088	b	0,649	d	0,197	b	0,034	b	0,0105	a	<0,005	b
5	0,112	a	0,080	b	0,048	a	<0,01	d	<0,001	c	10,60	b	0,090	a	0,660	b	0,199	b	0,034	a			<0,010	d
M	0,105		0,077		0,0452		<0,005		<0,001		10,27		0,087		0,649		0,190		0,0332		0,0095		<0,002	

	W		Co		Sn		Nb		B		As		Sb	
No.	%	M	%	M	%	M	%	M	%	M	%	M	%	M
1	1,59	d	3,23	a	0,0020	a	---	a	0,0011	a	0,0015	a	0,0005	e
2	1,73	a	3,24	a	0,0021	a	0,055	b	0,0021	e	0,0023	a	<0,0010	a
3	1,73	b	3,26	b	0,0025	b	0,055	b	0,0022	a	0,0028	e	0,0026	a
4	1,75	b	3,29	d	<0,005	b	0,055	a	<0,005	b	<0,005	b	<0,010	b
5	1,87	a	3,33	b	<0,010	d	0,057	d			<0,010	d	<0,010	d
M	1,72		3,26		0,0024		0,055		0,0019		0,0028		<0,01	

If "---" appears in the table, this means that an outlier has been excluded.

A data set consists of at least two individual values.

M: weighted mean value of the data set values

Analytical methods used for certification (M)

a Spark excitation – optical emission spectrometry
b Inductively coupled plasma – optical emission spectrometry
c Combustion analysis
d Wavelength dispersive X-ray fluorescence analysis
e Inductively coupled plasma – mass spectrometry

Accepted as TAZ CRM (Rev. 0) on 9 February 2026
Date of this Revision 1: 2 March 2026 (re-evaluation incorporating results from ICP-MS analyses)

Moritz Winter, M.Sc.
Head of Reference Materials Production

This certified reference material was manufactured in accordance with DIN EN ISO 17034 in combination with DIN EN ISO/IEC 17025. TAZ GmbH is accredited as a reference material producer according to DIN EN ISO 17034. The accreditation is valid for the scope specified in the annex to the accreditation certificate D-RM-11169-02-00. The Deutsche Akkreditierungsstelle (DAkkS) is a signatory of the Multilateral Agreement (MLA) between EA, ILAC and IAF for mutual recognition.

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- End of the Certificate -