

Preliminary Certificate

Microanalytical Reference Material

SPLT-NP-B01

Nano-particulate pressed powder pellet

Certified Values

Analyte	Value	Uncertainty (95% CL)	Unit	k
Ca	38.0	1.0	g/100g	
Li	3.5	1.0	μg/g	2.262
B*	49.2	7.9	μg/g	2.776
Na	369	19	μg/g	
Mg	5932	259	μg/g	
Al	2244	126	μg/g	
Si	10013	597	μg/g	
P	127	7	μg/g	
K	478	32	μg/g	
Cr	4.74	1.72	μg/g	2.262
Fe	1941	101	μg/g	
Co	0.74	0.07	μg/g	2.262
Ni	3.32	0.58	μg/g	2.262
Cu	25.4	3.4	μg/g	2.262
Zn	24.4	4.2	μg/g	2.262
Ga	0.64	0.05	μg/g	
Rb	3.17	0.18	μg/g	
Sr	738	23	μg/g	
Y	10.1	1.0	μg/g	

Certified Values

Analyte	Value	Uncertainty (95% CL)	Unit	k
Cs	0.46	0.06	μg/g	
Ba	31.5	1.8	μg/g	
La	6.36	0.33	μg/g	
Ce	2.54	0.40	μg/g	
Pr	1.33	0.08	μg/g	
Nd	5.2	0.5	μg/g	
Sm	0.99	0.09	μg/g	
Eu	0.22	0.02	μg/g	
Gd	1.05	0.09	μg/g	
Tb	0.14	0.01	μg/g	
Dy	0.91	0.09	μg/g	
Er	0.53	0.04	μg/g	
Tm	0.058	0.009	μg/g	
Yb	0.40	0.04	μg/g	
Lu	0.05	0.01	μg/g	
Pb	3.83	0.95	μg/g	2.262
Th	0.32	0.06	μg/g	
U	0.53	0.10	μg/g	

Information Values

Analyte	Value	Uncertainty (95% CL)	Unit
Be	1.64		μg/g
S	1597	214	μg/g
Sc	0.87		μg/g
Ti	97		μg/g
V	3.5		μg/g
Mn	303	58	μg/g
Ge	0.097		μg/g
As	1.96		μg/g
Zr	6.2		μg/g
Nb	0.365		μg/g
Mo	0.74		μg/g

Information Values

Analyte	Value	Uncertainty (95% CL)	Unit
Ag	0.1		μg/g
Cd	0.279		μg/g
Sn	0.26		μg/g
Sb	0.235		μg/g
Ho	0.19	0.02	μg/g
Hf	0.134		μg/g
Ta	0.04		μg/g
W	0.091		μg/g
Tl	0.026		μg/g
Bi	0.027		μg/g

The assigned values represent the mean of laboratory means. The reference values were obtained through measurements performed on the nano-powder using two or more methods (ICP-MS, ICP-AES, XRF) in two or three competent laboratories. Further, each laboratory's performance was statistically evaluated following recommendations from ISO Guide 35^[1].

Homogeneity and stability tests were performed on the nano-pellets using LA-ICP-MS and in accordance with ASTM E826-14^[2], ISO 13528^[3], and ISO Guide 35.

The expanded uncertainty is composed of the uncertainty components from characterisation, as well as from the homogeneity, and stability. Unless stated otherwise a coverage factor $k = 2$ was applied to reach a confidence level of 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement (GUM)^[4].

Information values did not fulfil all necessary statistical criteria of a reference value and should neither be considered for calibration nor validation. The information values, which have an uncertainty were demoted due to the calculated combined expanded uncertainty not being usable and or due to insufficient characterisation.

*Boron was characterized using Solution-SF-ICP-MS as a single reference measurement procedure (as defined in ISO/IEC Guide 99^[5]) in a single laboratory.

Strontium Isotope Measurement Information Values (ID-TIMS)

Analyte	Value	Uncertainty (2SD)	Uncertainty (95% CL)
⁸⁷ Sr/ ⁸⁶ Sr	0.709214	0.000030	0.000040

The ⁸⁷Sr/⁸⁶Sr isotope ratio was determined using an accredited method in which three aliquots were measured by TIMS after acid digestion and strontium separation.

Pellet serial number: {SERIENNUMMER}

Date of dispatch: {LIEFERDATUM}

This certificate was approved by the myStandards GmbH, Kiel, 04.04.2023

Signed:

Simon Nordstad
CEO & Founder
Method Development & Production

Christina Wittke
CEO & Founder
Management & Marketing

Intended Use

This microanalytical certified reference material (CRM) is designed for use by laboratories undertaking the determination of major and trace element mass fractions in calcium carbonate and equivalent matrices with LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry). It is suitable for calibration and as a secondary reference material for the assessment of a measurement procedure and quality control. Note that the material may only be used for a single purpose in the same measurement process. For example, it must not be used for calibration and method validation at the same time.

Description of the CRM

This CRM is a nanoparticulate pressed powder pellet of the speleothem powder "SPLT-NP-B01". The original stalagmite was milled to a particle size of $< 40 \mu\text{m}$. The resulting powder was subjected to our own material-specific milling protocol, freeze-dried, homogenised, and split into batches. Batch number 1 was pressed, into 10 mm diameter pellets, without any binders using a programmable hydraulic press. The fortification of contrasting colour surrounding the reference material is, according to the manufacturer, an "organic compound". The exact composition is not specified any closer. The certificate of analysis is available on demand.

Handling advice and Storage information

Avoid touching the pellet's surface directly in order to prevent contamination. Also, do not clean the surface with any liquids as it may compromise the pellet's integrity.

Please note the label marks the bottom of the pellet.

Store the CRM in a desiccator and or in a dark and dry environment.

The myStandards GmbH cannot be held responsible for changes that happen during storage of the material at the customer's premises, especially with respect to opened samples.

Period of Validity

Provided the storage and handling conditions are met, no chemical alteration is known to exist, and the assigned values will remain stable. Therefore, the product information and assigned values for this CRM are valid for one year, pending stability monitoring, from the date of dispatch. This validity may be extended as further evidence of stability becomes available. The manufacturer will inform the customer if any alterations occur.

Safety instructions

Nano-particulate powders can cause harm if ingested, inhaled or in contact with skin. In their pressed form however, they do not exhibit any dusting. If a pellet should accidentally break, we advise wearing a dust mask during clean up.

Minimal sample size

The minimal sample size corresponds to a spot size of $80 \mu\text{m}$.

Further ablation conditions and signal acquisition parameters during homogeneity- and stability-testing were:

<i>Laser fluence</i>	<i>6.5 J/cm²</i>
<i>Repetition rate</i>	<i>10 Hz</i>
<i>Background</i>	<i>10 s</i>
<i>Signal acquisition</i>	<i>40 s</i>

Metrological Traceability

This CRM has been produced in accordance with the recommendations specified in ISO 17034^[6] and ISO Guide 35 and are traceable to the base units of SI via calibrated measurements in competent and accredited laboratories (ISO 17025^[7]). The value for strontium isotope measurements is also traceable to the units of SI via calibrated measurements using a single reference measurement procedure in an accredited laboratory (ISO 17025).

Further Information

A detailed report on the certification of the reference material is available on request or can be downloaded from www.my-standards.com.

Sample handling prior to pelletising is performed manually. Therefore, small amounts of the sample material may be seen on the fortification, this does not reduce the integrity of the CRM. Please refrain from using this part of the pellet.

The pellets are sold exclusively via the myStandards GmbH and authorised subcontractors.

Document History

Version	Date	Changes applied
1.0	15.06.2022	First publication
1.1	04.04.2023	Updated link to terms and conditions; Adaptation to automatically fill in the date and individual pellet characteristics

References

[1] **ISO Guide 35:2017 (E)**, *Reference materials – Guidance for characterization and assessment of homogeneity and stability*

[2] **ASTM E826-14**, *Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectroscopy*. ASTM International, West Conshohocken, PA, 2014. www.astm.org

[3] **ISO 13528:2015 (E)**, *Statistical methods for use in proficiency testing by interlaboratory comparison*

[4] **ISO/IEC Guide 98-3:2008**, *Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[5] **ISO/IEC Guide 99:2007**, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

[6] **EN ISO 17034:2016 (D/E)**, *General requirements for the competence of reference material producers*

[7] **EN ISO/IEC 17025:2017 (D/E)**, *General requirements for the competence of testing and calibration laboratories*

Legal notice

Our order, sales and delivery conditions apply. The valid version of our general terms and conditions (status 01.09.2019) - can be found on our website: <https://www.my-standards.com/terms-and-conditions/>. They are also available on request.