

Certificate of Certified Reference Material

NCS DC71320 —NCS DC71322

Spodumene

Issued in 2021

Approved by China National Analysis Center for Iron and Steel

(Beijing China)

These Certified Reference Materials are prepared in accordance with the ISO guides 30-35. The intended use for this CRM is for the quality control in spodumene analysis, the evaluating methods of analysis and the calibration of analytical instruments.

Certified Values and Uncertainty

Composition	NCS DC 71320		NCS DC 71321		NCS DC 71322	
	Certified Value	Uncertainty	Certified Value	Uncertainty	Certified Value	Uncertainty
Li ₂ O (%)	6.30	0.18	6.23	0.11	1.30	0.04
Al ₂ O ₃ (%)	25.35	0.19	25.28	0.23	15.88	0.23
CaO (%)	0.14	0.01	0.070	0.003	0.27	0.02
FeO (%)	(0.26)		(0.16)		(0.14)	
K ₂ O (%)	0.17	0.01	0.22	0.02	2.38	0.10
LOI (%)	0.97	0.10	(0.73)		(1.02)	
MgO (%)	0.060	0.010	0.035	0.005	0.048	0.003
MnO (%)	0.16	0.01	0.15	0.01	0.087	0.003
Na ₂ O (%)	1.15	0.05	1.23	0.04	3.81	0.30
P ₂ O ₅ (%)	0.027	0.001	0.025	0.003	0.23	0.01
SiO ₂ (%)	64.20	0.18	64.36	0.18	74.27	0.86
TFe ₂ O ₃ (%)	0.75	0.09	0.62	0.08	0.36	0.06
Ba (µg /g)	12.3	0.4	3.21	0.22	4.8	0.4
Be (µg /g)	39.6	2.4	0.106*	0.007*	144	8
Bi (µg /g)	5.45	0.28	2.97	0.28	1.21	0.06
Ce (µg /g)	(0.69)		(0.22)		0.60	0.03
Cs (µg /g)	70	5	0.081*	0.006*	113	5
Hf (µg /g)	2.92	0.16	(3.1)		4.79	0.24
La (µg /g)	(0.34)		(0.10)		0.357	0.016
Nb (µg /g)	11.4	0.8	10.8	0.8	76	10
Ni (µg /g)	2.03	0.12	1.23	0.12	(0.87)	
Rb (µg /g)	98	14	145	12	0.098*	0.003*
S (µg /g)	(70)		(50)		(60)	
Sc (µg /g)	(0.44)		(0.38)		(0.46)	
Sr (µg /g)	6.8	0.6	3.9	0.4	45	3
Ta (µg /g)	12.9	1.0	15.8	1.4	51	5
Th (µg /g)	1.39	0.08	1.07	0.12	0.71	0.03
Ti (µg /g)	96	10	67	6	47.3	1.4
U (µg /g)	0.75	0.06	0.77	0.08	9.6	1.8
V (µg /g)	(4.1)		(2.4)		(3.0)	
W (µg /g)	2.47	0.24	1.88	0.28	2.00	0.10
Y (µg /g)	(1.8)		(1.7)		2.94	0.24
Yb (µg /g)	(0.035)		(0.016)		(0.028)	
Zn (µg /g)	114	10	70	6	80	5
Zr (µg /g)	84	5	76	10	112	5

Data in () is for reference only, value with * is in percent..

Note:

- 10 independent laboratories take part in the analytical work.

The analysis results for elements is no less 6 labs.

Uncertainty is calculated by $U = t_{0.05(N-1)} \cdot s / \sqrt{U_a^2 + U_b^2}$, U_a is got by standard deviation of the data from different labs, U_b is got by standard deviation of methods. S means standard deviation, N means number of data.

2.The sample is powder with size less 0.074mm packed in plastic bottle.

The minimum package is 50 grams. The minimum weight for analysis is: LOI: 1.0g, FeO: 0.5g, Others is 0.1g.

3. The valid time for the certified value is 10 years.

Analytical Methods

Element	methods	Element	methods	Element	methods
Li ₂ O	DMA-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-MS DMA-ICP-MS	Ba	FUS-XRF DMA-ICP-MS DMA-ICP-AES DF-ICP-AES DF-ICP-MS	Sr	DMA-ICP-MS DMA-ICP-AES DF-ICP-AES DF-ICP-MS
Al ₂ O ₃	FUS-XRF VOL DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Be	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS	Ta	DMA-ICP-MS DAF-ICP-MS DF-ICP-MS
CaO	FUS-XRF DAF-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Bi	DMA-ICP-MS DMA-AFS DF-ICP-MS	Th	DMA-ICP-MS DF-ICP-MS
FeO	VOL	Ce	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS	Ti	DMA-ICP-MS DMA-ICP-AES DF-ICP-AES COL, FUS-XRF
K ₂ O	FUS-XRF DAF-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Cs	DMA-AAS DMA-ICP-MS DF-ICP-MS	U	DMA-ICP-MS DF-ICP-MS
LOI	GR	Hf	DMA-ICP-MS DMA-ICP-AES DAF-ICP-MS DF-ICP-MS	V	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS
MgO	FUS-XRF DAF-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	La	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS	W	DMA-ICP-MS DF-ICP-MS POL
MnO	FUS-XRF DAF-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Nb	DMA-ICP-MS DAF-ICP-MS DF-ICP-MS	Y	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS
Na ₂ O	FUS-XRF DAF-AAS DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Ni	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS	Yb	DMA-ICP-MS DF-ICP-MS
P ₂ O ₅	FUS-XRF DAF-ICP-AES DMA-ICP-AES DF-ICP-AES	Rb	DMA-ICP-MS DMA-AAS DF-ICP-AES DF-ICP-MS	Zn	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS
SiO ₂	FUS-XRF GR, VOL DAF-ICP-AES	S	VOL IR	Zr	DMA-ICP-MS DMA-ICP-AES DAF-ICP-MS DF-ICP-MS FUS-XRF
TFe ₂ O ₃	FUS-XRF DAF-ICP-AES DMA-ICP-AES COL DF-ICP-AES	Sc	DMA-ICP-MS DMA-ICP-AES DF-ICP-MS		

Note:

DAF: digestion by Alkali fusion

DF: digestion by mixed acids in airtight

DMA: digestion by mixed acids

FUS: fusion

AAS: Flame Atomic Absorption Spectrometry

AFS: Atomic fluorescence Spectrometry

COL: Colorimetric method

GR: Gravimetry

ICP-AES: Inductively Coupled Plasma- Atomic Emission Spectrography

ICP-MS: Inductively Coupled Plasma- Mass Spectrometry

IR : Infrared absorption

POL: polarographic method

VOL: Volumetry

XRF: X - ray fluorescence

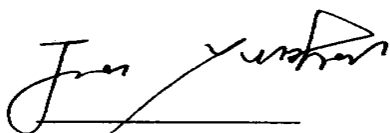
Traceability, stability and homogeneity

All the laboratories take part in the analysis are with ISO17025 certificate, all the methods and instruments used are fulfilled the requirement of metrology to guarantee the traceability. Randomly selected samples were test by above method for monitoring the homogeneity and stability. The results show that the material is homogenous and stable when stored properly.

Statement:

This material is used only in labs and for analysis work, producer will be not responsible for any problem caused by misuse or not properly store.

Please check carefully the package, quantity and type of the material after receiving it. Related compensation is only limited in the certified materials, any other losses will be not included.



Jia Yunhai

Laboratory Director