

The Technical Association of Refractories, Japan

Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories

J R R M 4 0 1 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value						
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃
Certified value	6.42 ₄	8.10 ₆	3.89 ₀	0.20 ₈	81.2 ₄	0.01 ₇	0.01 ₁	0.00 ₆	0.00 ₃	0.00 ₄	0.03 ₅	0.01 ₆
Laboratories												
L ₁	6.34 ₂	8.03 ₁	3.86 ₆	0.21 ₅	81.5 ₆	0.01 ₆	0.01 ₁	0.00 ₇	0.00 ₁	0.00 ₃	0.03 ₂	0.00 ₆
L ₂	6.41 ₆	8.14 ₃	3.88 ₁	0.22 ₀	81.1 ₀	—	—	0.00 ₈	0.00 ₄	—	—	—
L ₃	6.44 ₂	8.15 ₀	3.88 ₄	0.21 ₀	81.1 ₄	0.01 ₈	0.01 ₁	0.00 ₈	0.00 ₂	0.00 ₄	0.03 ₅	0.01 ₁
L ₄	6.37 ₄	8.17 ₈	3.96 ₂	0.20 ₂	81.1 ₂	0.01 ₇	0.01 ₀	0.00 ₄	0.00 ₃	0.00 ₄	0.04 ₄	0.02 ₅
L ₅	6.42 ₈	8.13 ₂	3.83 ₈	0.20 ₆	81.5 ₂	—	—	—	—	—	—	—
L ₆	6.53 ₈	8.01 ₈	3.95 ₃	0.22 ₂	81.2 ₆	0.01 ₈	0.01 ₁	—	—	0.00 ₅	—	0.03 ₂
L ₇	6.39 ₀	8.05 ₀	3.86 ₄	0.19 ₆	81.0 ₅	—	—	—	—	—	—	—
L ₈	6.44 ₂	8.16 ₈	3.87 ₄	0.20 ₄	81.2 ₀	0.01 ₄	0.01 ₁	0.00 ₄	0.00 ₄	—	0.03 ₂	0.00 ₆
L ₉	6.44 ₈	8.08 ₄	3.88 ₆	0.19 ₉	81.1 ₈	—	—	0.00 ₄	0.00 ₂	—	0.03 ₂	—
Average (\bar{X})	6.424 ₄	8.106 ₀	3.889 ₈	0.208 ₂	81.23 ₇	0.016 ₆	0.010 ₈	0.005 ₈	0.002 ₇	0.004 ₀	0.035 ₀	0.016 ₀
Standard deviation (Reproducibility)	$s_{\bar{x}}$											
deviation (Reproducibility without laboratories)	$s_{I(T)}^{*1}$											
Uncertainty C (95%) ^{*2}												

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

- List of laboratories : Krosaki Corporation, Kyushu Refractories Co.,Ltd., Kawasaki Refractories Co.,Ltd., The Industrial Technology Center of Okayama Prefecture, Yotai Refractories Co.,Ltd., Asahi Glass Co.,Ltd., Harima Ceramic Co.,Ltd., Shinagawa Refractories Co.,Ltd., Toshiba Ceramics Co.,Ltd.
- Analytical techniques : JIS R 2212-4(Method for chemical analysis of refractory products — Part 4:Magnesite and/or dolomite refractories)
- Analytical values : Each value is the average of two values obtained by two measurements on different days. These analysis values are shown converted into LOI (Loss on ignition) component free values from the February 22, 2008 v20080222 version on.
- Outlier tests were carried out by Grubbs test. The samples rejected by Grubbs tests were discussed in view of analytical techniques and it was determined whether the outliers should be adopted or not.
- Date of preparation : February, 1989

Prepared, and Values given and certified by

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories

J R R M 4 0 2 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	5.46 ₂	1.99 ₉	5.05 ₀	3.57 ₀	83.7 ₇	0.02 ₆	0.01 ₁	0.01 ₀	0.00 ₁	0.00 ₆	0.07 ₇	0.12 ₇	
Laboratories	L ₁	5.36 ₁	1.99 ₈	5.03 ₈	3.60 ₆	83.8 ₂	0.02 ₆	0.01 ₁	0.01 ₂	0.00 ₁	0.00 ₅	0.07 ₆	0.12 ₄
	L ₂	5.44 ₃	2.05 ₄	5.08 ₈	3.51 ₁	83.6 ₉	—	—	0.01 ₂	0.00 ₁	—	—	—
	L ₃	5.50 ₂	1.98 ₃	5.05 ₄	3.66 ₁	83.6 ₆	0.02 ₈	0.01 ₀	0.00 ₆	0.00 ₁	0.00 ₆	0.07 ₀	0.12 ₃
	L ₄	5.41 ₁	1.98 ₄	5.09 ₀	3.51 ₅	83.8 ₂	0.02 ₆	0.01 ₀	0.01 ₁	0.00 ₁	0.00 ₈	0.08 ₄	0.12 ₇
	L ₅	5.46 ₃	2.05 ₃	4.94 ₀	3.51 ₂	83.9 ₀	—	—	—	—	—	—	—
	L ₆	5.49 ₄	1.99 ₀	5.11 ₈	3.65 ₇	83.8 ₈	0.02 ₈	0.01 ₁	—	—	0.00 ₇	—	0.12 ₅
	L ₇	5.53 ₅	1.95 ₂	5.04 ₄	3.56 ₈	83.7 ₅	—	—	—	—	—	—	—
	L ₈	5.36 ₉	2.00 ₄	5.07 ₀	3.55 ₄	83.6 ₈	0.02 ₄	0.01 ₁	0.01 ₁	0.00 ₂	—	0.07 ₈	0.13 ₄
	L ₉	5.58 ₄	1.97 ₂	5.00 ₈	3.55 ₀	83.7 ₄	—	—	0.00 ₈	0.00 ₁	—	0.07 ₈	—
Average (\bar{X})	5.462 ₄	1.998 ₉	5.050 ₀	3.570 ₄	83.77 ₁	0.026 ₄	0.010 ₆	0.010 ₀	0.001 ₂	0.006 ₅	0.077 ₂	0.126 ₆	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.074 ₉	0.080 ₁	0.052 ₃	0.066 ₂	0.09 ₁	—	—	—	—	—	—	—
	(Reproducibility without laboratories) $s_{I(T)}$ **	0.034 ₉	0.017 ₃	0.029 ₃	0.052 ₀	0.10 ₉	—	—	—	—	—	—	—
Uncertainty C (95%) **2	0.05 ₈	0.06 ₂	0.04 ₀	0.05 ₁	0.0 ₇	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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J R R M 4 0 3 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	8.14 ₄	4.06 ₀	1.55 ₃	0.61 ₅	85.4 ₈	0.00 ₃	0.01 ₄	0.00 ₄	0.00 ₁	0.01 ₀	0.04 ₄	0.03 ₁	
Laboratories	L ₁	8.02 ₃	4.03 ₀	1.54 ₀	0.62 ₄	85.7 ₃	0.00 ₃	0.01 ₄	0.00 ₁	0.00 ₀	0.00 ₉	0.03 ₉	0.03 ₀
	L ₂	8.12 ₄	4.08 ₇	1.55 ₂	0.60 ₆	85.4 ₆	—	—	0.00 ₇	0.00 ₂	—	—	—
	L ₃	8.16 ₈	4.06 ₄	1.53 ₆	0.61 ₉	85.5 ₁	0.00 ₄	0.01 ₄	0.00 ₄	0.00 ₀	0.00 ₉	0.03 ₈	0.03 ₂
	L ₄	8.13 ₁	4.07 ₈	1.57 ₅	0.60 ₈	85.2 ₉	0.00 ₂	0.01 ₄	0.00 ₄	0.00 ₁	0.01 ₀	0.04 ₄	0.03 ₀
	L ₅	8.08 ₈	4.09 ₀	1.55 ₃	0.61 ₀	85.5 ₆	—	—	—	—	—	—	—
	L ₆	8.21 ₈	4.05 ₈	1.57 ₆	0.61 ₈	85.5 ₄	0.00 ₃	0.01 ₄	—	—	0.01 ₁	—	0.03 ₂
	L ₇	8.16 ₁	4.01 ₇	1.55 ₂	0.63 ₄	85.5 ₅	—	—	—	—	—	—	—
	L ₈	8.09 ₄	4.09 ₄	1.53 ₄	0.60 ₈	85.3 ₆	0.00 ₃	0.01 ₆	0.00 ₄	0.00 ₁	—	0.04 ₂	0.03 ₀
	L ₉	8.29 ₁	4.02 ₂	1.55 ₆	0.60 ₄	85.3 ₅	—	—	0.00 ₃	0.00 ₁	—	0.05 ₈	—
Average (\bar{X})	8.144 ₂	4.060 ₀	1.552 ₇	0.614 ₆	85.48 ₃	0.003 ₀	0.014 ₄	0.003 ₈	0.000 ₈	0.009 ₈	0.043 ₈	0.030 ₈	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.078 ₁	0.036 ₅	0.015 ₂	0.010 ₁	0.13 ₅	—	—	—	—	—	—	—
	(Reproducibility without laboratories) $s_{I(T)}^{**}$	0.031 ₉	0.020 ₅	0.008 ₈	0.008 ₄	0.11 ₅	—	—	—	—	—	—	—
Uncertainty C (95%) ^{**2}	0.06 ₀	0.02 ₈	0.01 ₂	0.00 ₈	0.1 ₀	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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J R R M 4 0 4 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	1.22 ₃	6.01 ₄	2.90 ₈	1.78 ₈	88.0 ₂	0.00 ₇	0.03 ₀	0.00 ₉	0.00 ₁	0.00 ₆	0.05 ₃	0.01 ₁	
Laboratories	L ₁	1.21 ₀	6.03 ₇	2.90 ₈	1.80 ₈	87.9 ₆	0.00 ₆	0.03 ₀	0.01 ₀	0.00 ₁	0.00 ₅	0.05 ₃	0.00 ₆
	L ₂	1.24 ₉	5.98 ₆	2.90 ₆	1.72 ₃	87.9 ₆	—	—	0.01 ₄	0.00 ₂	—	—	—
	L ₃	1.26 ₅	5.95 ₄	2.89 ₄	1.82 ₆	87.8 ₉	0.00 ₈	0.03 ₀	0.00 ₈	0.00 ₀	0.00 ₆	0.05 ₈	0.01 ₀
	L ₄	1.22 ₈	6.06 ₁	2.96 ₅	1.70 ₀	87.9 ₈	0.00 ₆	0.02 ₈	0.00 ₉	0.00 ₁	0.00 ₇	0.05 ₅	0.01 ₈
	L ₅	1.14 ₆	6.03 ₈	2.91 ₆	1.78 ₀	88.1 ₀	—	—	—	—	—	—	—
	L ₆	1.23 ₂	5.95 ₂	2.92 ₆	1.87 ₂	88.1 ₄	0.00 ₇	0.02 ₉	—	—	0.00 ₇	—	0.01 ₄
	L ₇	1.20 ₄	6.01 ₁	2.90 ₆	1.76 ₈	88.2 ₄	—	—	—	—	—	—	—
	L ₈	1.20 ₂	6.02 ₈	2.87 ₄	1.80 ₅	87.9 ₄	0.00 ₇	0.03 ₁	0.00 ₈	0.00 ₂	—	0.05 ₈	0.00 ₈
	L ₉	1.27 ₂	6.05 ₈	2.88 ₀	1.78 ₈	87.9 ₄	—	—	0.00 ₇	0.00 ₁	—	0.04 ₃	—
Average (\bar{X})	1.223 ₁	6.013 ₉	2.908 ₃	1.785 ₈	88.01 ₇	0.006 ₃	0.029 ₆	0.009 ₃	0.001 ₂	0.006 ₃	0.053 ₀	0.011 ₂	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.038 ₄	0.041 ₀	0.027 ₀	0.051 ₂	0.11 ₆	—	—	—	—	—	—	—
	(Reproducibility without laboratories) $s_{I(T)}$ **	0.005 ₄	0.025 ₉	0.024 ₀	0.034 ₄	0.11 ₃	—	—	—	—	—	—	—
Uncertainty C (95%) **2	0.03 ₀	0.03 ₂	0.02 ₁	0.03 ₉	0.0 ₉	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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J R R M 4 0 5 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	3.47 ₉	1.37 ₂	1.34 ₆	1.69 ₀	91.9 ₅	0.05 ₄	0.07 ₄	0.00 ₉	0.01 ₅	0.01 ₄	0.12 ₀	0.01 ₁	
Laboratories	L ₁	3.46 ₆	1.34 ₄	1.33 ₄	1.69 ₄	92.1 ₄	0.05 ₁	0.07 ₁	0.00 ₆	0.00 ₇	0.01 ₀	0.11 ₄	0.01 ₁
	L ₂	3.41 ₂	1.38 ₉	1.33 ₀	1.67 ₀	91.9 ₆	—	—	—	0.01 ₅	—	—	—
	L ₃	3.56 ₁	1.34 ₀	1.33 ₈	1.69 ₄	92.0 ₂	0.05 ₈	0.07 ₄	0.00 ₈	0.01 ₂	0.01 ₈	0.12 ₅	0.01 ₃
	L ₄	3.40 ₄	1.42 ₈	1.36 ₇	1.63 ₂	91.9 ₂	0.05 ₁	0.07 ₄	0.01 ₁	0.02 ₂	0.01 ₃	0.12 ₀	0.01 ₂
	L ₅	3.35 ₈	1.38 ₂	1.36 ₆	1.66 ₄	92.1 ₈	—	—	—	—	—	—	—
	L ₆	3.54 ₀	1.37 ₈	1.36 ₂	1.75 ₀	91.9 ₀	0.05 ₉	0.07 ₃	—	—	0.01 ₃	—	0.01 ₃
	L ₇	3.59 ₂	1.35 ₁	1.35 ₁	1.76 ₁	91.8 ₁	—	—	—	—	—	—	—
	L ₈	3.43 ₂	1.39 ₀	1.32 ₁	1.67 ₄	91.7 ₄	0.05 ₃	0.07 ₆	0.01 ₀	0.02 ₁	—	0.11 ₈	0.00 ₈
	L ₉	3.54 ₆	1.34 ₆	1.34 ₂	1.67 ₃	91.8 ₆	—	—	0.00 ₉	0.01 ₅	—	0.12 ₂	—
Average (\bar{X})	3.479 ₀	1.372 ₀	1.345 ₇	1.690 ₂	91.94 ₈	0.054 ₄	0.073 ₆	0.008 ₈	0.015 ₃	0.013 ₅	0.119 ₈	0.011 ₄	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.087 ₃	0.030 ₀	0.016 ₈	0.041 ₂	0.14 ₆	—	—	—	—	—	—	—
	(Reproducibility without laboratories) $s_{I(T)}$ **	0.027 ₄	0.012 ₁	0.008 ₂	0.030 ₁	0.09 ₇	—	—	—	—	—	—	—
Uncertainty C (95%) **2	0.06 ₇	0.02 ₃	0.01 ₃	0.03 ₂	0.1 ₁	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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The Technical Association of Refractories, Japan

Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories

J R R M 4 0 6 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value						
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃
Certified value	1.19 ₆	1.13 ₉	0.87 ₄	4.80 ₅	91.8 ₅	0.00 ₄	0.01 ₁	0.00 ₂	0.00 ₀	0.00 ₆	0.04 ₁	0.01 ₃
Laboratories												
L ₁	1.17 ₀	1.15 ₃	0.87 ₂	4.91 ₆	91.6 ₆	0.00 ₄	0.01 ₁	0.00 ₁	0.00 ₀	0.00 ₅	0.03 ₉	0.01 ₃
L ₂	1.17 ₀	1.14 ₈	0.87 ₈	4.75 ₈	91.9 ₀	—	—	0.00 ₅	0.00 ₁	—	—	—
L ₃	1.22 ₂	1.12 ₀	0.86 ₀	4.89 ₂	91.7 ₈	0.00 ₄	0.01 ₀	0.00 ₆	0.00 ₀	0.00 ₈	0.04 ₄	0.01 ₄
L ₄	1.18 ₈	1.14 ₂	0.88 ₄	4.69 ₂	91.8 ₂	0.00 ₄	0.01 ₀	0.00 ₁	0.00 ₀	0.00 ₅	0.04 ₀	0.01 ₁
L ₅	1.23 ₈	1.15 ₀	0.84 ₉	4.73 ₈	91.8 ₄	—	—	—	—	—	—	—
L ₆	1.20 ₆	1.15 ₀	0.89 ₃	4.88 ₉	91.8 ₀	0.00 ₄	0.01 ₁	—	—	0.00 ₅	—	0.01 ₄
L ₇	1.20 ₄	1.10 ₁	0.89 ₆	4.81 ₇	92.0 ₈	—	—	—	—	—	—	—
L ₈	1.15 ₄	1.15 ₆	0.85 ₈	4.78 ₂	91.9 ₇	0.00 ₄	0.01 ₁	0.00 ₀	0.00 ₀	—	0.03 ₈	0.01 ₂
L ₉	1.21 ₀	1.13 ₄	0.87 ₆	4.75 ₈	91.8 ₁	—	—	0.00 ₁	0.00 ₀	—	0.04 ₆	—
Average (\bar{X})	1.195 ₈	1.139 ₃	0.874 ₀	4.804 ₇	91.85 ₁	0.004 ₀	0.010 ₆	0.002 ₃	0.000 ₂	0.005 ₈	0.041 ₄	0.012 ₈
Standard deviation (Reproducibility)	$s_{\bar{x}}$					—	—	—	—	—	—	—
Standard deviation (Reproducibility without laboratories)	$s_{I(T)}$ *					—	—	—	—	—	—	—
Uncertainty C (95%) **2						—	—	—	—	—	—	—

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

- List of laboratories : Krosaki Corporation, Kyushu Refractories Co.,Ltd., Kawasaki Refractories Co.,Ltd., The Industrial Technology Center of Okayama Prefecture, Yotai Refractories Co.,Ltd., Asahi Glass Co.,Ltd., Harima Ceramic Co.,Ltd., Shinagawa Refractories Co.,Ltd., Toshiba Ceramics Co.,Ltd.
- Analytical techniques : JIS R 2212-4(Method for chemical analysis of refractory products — Part 4:Magnesite and/or dolomite refractories)
- Analytical values : Each value is the average of two values obtained by two measurements on different days. These analysis values are shown converted into LOI (Loss on ignition) component free values from the February 22, 2008 v20080222 version on.
- Outlier tests were carried out by Grubbs test. The samples rejected by Grubbs tests were discussed in view of analytical techniques and it was determined whether the outliers should be adopted or not.
- Date of preparation : February, 1989

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories

J R R M 4 0 7 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	2.43 ₂	0.10 ₀	2.14 ₅	0.67 ₅	94.5 ₅	0.00 ₃	0.01 ₄	0.00 ₄	0.00 ₁	0.08 ₀	0.04 ₄	0.02 ₃	
Laboratories	L ₁	2.36 ₅	0.09 ₆	2.16 ₆	0.69 ₉	94.4 ₀	0.00 ₃	0.01 ₄	0.00 ₅	0.00 ₁	—	0.04 ₃	0.02 ₂
	L ₂	2.43 ₄	0.10 ₁	2.15 ₈	0.65 ₈	94.4 ₂	—	—	0.00 ₇	0.00 ₂	—	—	—
	L ₃	2.50 ₆	0.10 ₄	2.14 ₄	0.69 ₈	94.4 ₁	0.00 ₄	0.01 ₄	0.00 ₂	0.00 ₀	0.08 ₂	0.04 ₂	0.02 ₄
	L ₄	2.39 ₅	0.10 ₀	2.14 ₄	0.66 ₀	94.6 ₆	0.00 ₃	0.01 ₃	0.00 ₄	0.00 ₀	0.07 ₉	0.04 ₈	0.02 ₃
	L ₅	2.29 ₆	0.09 ₈	2.12 ₄	0.67 ₂	94.7 ₁	—	—	—	—	—	—	—
	L ₆	2.57 ₂	0.09 ₁	2.15 ₀	0.68 ₁	94.5 ₄	0.00 ₃	—	—	—	0.07 ₃	—	0.02 ₈
	L ₇	2.49 ₂	0.09 ₈	2.13 ₅	0.64 ₁	94.7 ₀	—	—	—	—	—	—	—
	L ₈	2.37 ₄	0.10 ₁	2.13 ₆	0.68 ₈	94.5 ₇	0.00 ₄	0.01 ₃	0.00 ₃	0.00 ₁	0.08 ₆	0.04 ₃	0.02 ₀
	L ₉	2.45 ₄	0.11 ₀	2.14 ₄	0.68 ₀	94.5 ₆	—	—	0.00 ₃	0.00 ₀	—	0.04 ₄	—
Average (\bar{X})	2.432 ₀	0.099 ₉	2.144 ₇	0.674 ₈	94.55 ₂	0.003 ₄	0.013 ₅	0.004 ₀	0.000 ₇	0.080 ₀	0.044 ₀	0.023 ₄	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.084 ₅	0.009 ₆	0.012 ₅	0.019 ₅	0.12 ₁	—	—	—	—	—	—	—
	(Reproducibility without laboratories) $s_{I(T)}$ **	0.020 ₄	0.005 ₀	0.007 ₂	0.017 ₄	0.07 ₅	—	—	—	—	—	—	—
Uncertainty C (95%) **2	0.06 ₅	0.00 ₇	0.01 ₀	0.01 ₅	0.0 ₉	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories

J R R M 4 0 8 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value							
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃	
Certified value	0.46 ₀	2.55 ₄	0.13 ₄	0.67 ₂	96.1 ₉	0.00 ₄	0.01 ₀	0.00 ₁	0.00 ₀	0.00 ₉	0.01 ₅	0.09 ₉	
Laboratories	L ₁	0.46 ₂	2.52 ₆	0.15 ₂	0.70 ₂	96.1 ₇	0.00 ₄	0.01 ₀	0.00 ₀	0.00 ₀	0.00 ₉	0.01 ₃	0.09 ₇
	L ₂	0.44 ₆	2.49 ₆	0.14 ₄	0.68 ₄	96.2 ₈	—	—	0.00 ₆	0.00 ₁	—	—	—
	L ₃	0.47 ₀	2.53 ₀	0.12 ₀	0.67 ₈	96.1 ₄	0.00 ₄	0.01 ₀	0.00 ₁	0.00 ₀	0.01 ₂	0.01 ₈	0.09 ₆
	L ₄	0.46 ₁	2.56 ₂	0.13 ₈	0.64 ₇	96.1 ₇	0.00 ₄	0.00 ₈	0.00 ₀	0.00 ₀	0.00 ₈	0.01 ₆	0.09 ₈
	L ₅	0.42 ₈	2.57 ₂	0.13 ₆	0.66 ₀	96.1 ₂	—	—	—	—	—	—	—
	L ₆	0.46 ₇	2.60 ₃	0.13 ₀	0.68 ₁	96.3 ₅	0.00 ₅	0.01 ₀	—	—	0.00 ₈	—	0.10 ₀
	L ₇	0.45 ₈	2.53 ₄	0.13 ₆	0.67 ₄	96.2 ₁	—	—	—	—	—	—	—
	L ₈	0.45 ₆	2.58 ₀	0.13 ₀	0.67 ₄	96.0 ₁	0.00 ₅	0.01 ₀	0.00 ₀	0.00 ₀	—	0.01 ₄	0.10 ₄
	L ₉	0.48 ₉	2.58 ₀	0.12 ₄	0.64 ₈	96.3 ₀	—	—	0.00 ₁	0.00 ₀	—	0.01 ₄	—
Average (\bar{X})	0.459 ₇	2.553 ₇	0.134 ₄	0.672 ₀	96.19 ₄	0.004 ₄	0.009 ₆	0.001 ₃	0.000 ₂	0.009 ₃	0.015 ₀	0.099 ₀	
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.016 ₆	0.062 ₆	0.009 ₈	0.021 ₈	0.10 ₄	—	—	—	—	—	—	
	(Reproducibility without laboratories) $s_{I(T)}$ **	0.008 ₄	0.019 ₀	0.002 ₃	0.010 ₉	0.08 ₂	—	—	—	—	—	—	
Uncertainty C (95%) **2	0.01 ₃	0.04 ₈	0.00 ₈	0.01 ₇	0.0 ₈	—	—	—	—	—	—	—	

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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J R R M 4 0 9 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value						
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃
Certified value	0.53 ₄	0.20 ₂	0.49 ₀	0.74 ₄	98.0 ₃	0.00 ₃	0.01 ₅	0.00 ₂	0.00 ₁	0.01 ₉	0.02 ₃	0.03 ₈
Laboratories												
L ₁	0.53 ₂	0.20 ₀	0.48 ₄	0.76 ₃	98.3 ₀	0.00 ₃	0.01 ₅	0.00 ₀	0.00 ₁	0.01 ₈	0.02 ₄	0.03 ₅
L ₂	0.50 ₃	0.20 ₈	0.49 ₅	0.73 ₃	97.9 ₄	—	—	0.00 ₅	0.00 ₁	—	—	—
L ₃	0.54 ₈	0.19 ₀	0.47 ₈	0.77 ₂	97.9 ₀	0.00 ₃	0.01 ₄	0.00 ₁	0.00 ₀	0.02 ₀	0.02 ₄	0.03 ₉
L ₄	0.55 ₂	0.20 ₇	0.50 ₀	0.72 ₉	97.8 ₅	0.00 ₃	0.01 ₄	0.00 ₂	0.00 ₂	0.01 ₈	0.02 ₄	0.03 ₉
L ₅	0.45 ₄	0.21 ₂	0.47 ₄	0.73 ₀	98.1 ₀	—	—	—	—	—	—	—
L ₆	0.56 ₅	0.20 ₀	0.50 ₀	0.74 ₈	98.2 ₄	0.00 ₃	0.01 ₅	—	—	0.01 ₉	—	0.03 ₈
L ₇	0.56 ₈	0.18 ₁	0.49 ₆	0.75 ₈	98.0 ₅	—	—	—	0.00 ₁	—	—	—
L ₈	0.52 ₆	0.20 ₆	0.49 ₂	0.74 ₇	97.9 ₆	0.00 ₄	0.01 ₅	0.00 ₁	0.00 ₁	—	0.02 ₀	0.03 ₈
L ₉	0.56 ₁	0.21 ₆	0.48 ₈	0.71 ₂	97.9 ₂	—	—	0.00 ₁	—	—	0.02 ₄	—
Average (\bar{X})	0.534 ₁	0.202 ₂	0.490 ₃	0.743 ₆	98.02 ₉	0.003 ₂	0.014 ₆	0.001 ₇	0.001 ₀	0.018 ₈	0.023 ₂	0.037 ₈
Standard deviation (Reproducibility)	$s_{\bar{x}}$											
deviation (Reproducibility without laboratories)	$s_{I(T)}^{**}$											
Uncertainty C (95%) ^{**2}												

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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J R R M 4 1 0 (Magnesia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Uncertified value						
						TiO ₂	MnO	Na ₂ O	K ₂ O	Cr ₂ O ₃	P ₂ O ₅	B ₂ O ₃
Certified value	0.18 ₈	0.05 ₈	0.05 ₀	0.59 ₅	99.0 ₈	0.00 ₃	0.01 ₀	0.00 ₁	0.00 ₀	0.00 ₃	0.04 ₅	0.02 ₆
Laboratories												
L ₁	0.17 ₈	0.06 ₅	0.04 ₈	0.60 ₇	99.0 ₆	0.00 ₂	0.01 ₀	0.00 ₀	0.00 ₀	0.00 ₄	0.04 ₆	0.02 ₃
L ₂	0.18 ₆	0.05 ₄	0.05 ₄	0.58 ₅	99.0 ₇	—	—	0.00 ₆	0.00 ₂	—	—	—
L ₃	0.18 ₅	0.04 ₄	0.04 ₀	0.60 ₆	99.0 ₀	0.00 ₄	0.00 ₉	0.00 ₁	0.00 ₀	0.00 ₄	0.04 ₈	0.02 ₈
L ₄	0.17 ₈	0.05 ₄	0.05 ₀	0.59 ₁	98.8 ₆	0.00 ₃	0.00 ₈	0.00 ₀	0.00 ₀	0.00 ₂	0.04 ₁	0.02 ₈
L ₅	0.14 ₆	0.05 ₈	0.05 ₆	0.58 ₄	99.1 ₃	—	—	—	—	—	—	—
L ₆	0.17 ₉	0.05 ₆	0.05 ₃	0.61 ₈	99.2 ₀	0.00 ₃	0.00 ₉	—	—	0.00 ₃	—	0.02 ₆
L ₇	0.22 ₃	0.05 ₄	0.04 ₇	0.59 ₄	99.2 ₄	—	—	—	—	—	—	—
L ₈	0.18 ₄	0.05 ₀	0.04 ₈	0.60 ₂	99.0 ₈	0.00 ₄	0.01 ₂	0.00 ₁	0.00 ₁	—	0.04 ₄	0.02 ₄
L ₉	0.22 ₆	0.08 ₆	0.05 ₃	0.56 ₇	99.0 ₈	—	—	0.00 ₀	0.00 ₀	—	—	—
Average (\bar{X})	0.187 ₉	0.057 ₉	0.049 ₉	0.594 ₉	99.08 ₀	0.003 ₂	0.009 ₆	0.001 ₃	0.000 ₅	0.003 ₃	0.044 ₈	0.025 ₈
Standard deviation (Reproducibility)	$s_{\bar{x}}$											
deviation (Reproducibility without laboratories)	$s_{I(T)}^{**}$											
Uncertainty C (95%) ^{**2}												

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition. * 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_{\bar{x}} / \sqrt{\ell}$ (ℓ = number of laboratories)

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