

The Technical Association of Refractories, Japan
Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories
J R R M 6 0 1 (Zircon-Zirconia Refractory)
Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		0.26 ₃	0.11 ₉	0.10 ₁	0.16 ₈	5.58 ₈	0.06 ₄	0.00 ₄	0.00 ₂	0.00 ₇	0.00 ₃	93.6 ₈	1.59 ₂	92.0 ₈
Laboratories	L ₁	0.23 _{7 c}	0.10 _{0 v}	0.09 _{5 c}	0.16 _{6 c}	5.57 _{2 i}	0.06 _{2 i}	0.00 _{8 a}	0.00 _{5 a}	0.00 _{6 c}	0.00 _{4 i}	93.4 _{7 g}	1.57 _{1 x}	—
	L ₂	0.26 _{2 c}	0.10 _{4 i}	0.09 _{2 c}	0.16 _{8 i}	5.55 _{4 i}	0.06 _{0 i}	0.00 _{6 a}	0.00 _{2 a}	0.00 _{5 c}	0.00 _{4 i}	93.4 _{9 g}	1.59 _{7 i}	—
	L ₃	0.26 _{1 G}	0.13 _{3 i}	0.09 _{6 c}	0.16 _{8 i}	5.53 _{8 i}	0.05 _{2 i}	0.00 _{2 a}	0.00 _{3 a}	0.00 _{8 c}	0.00 _{2 i}	93.9 _{3 g}	1.60 _{4 i}	—
	L ₄	0.27 _{0 G}	0.14 _{9 a}	0.10 _{6 c}	0.16 _{9 c}	5.59 _{6 a}	0.06 _{6 a}	0.00 _{4 a}	0.00 _{2 a}	0.00 _{8 c}	0.00 _{4 a}	93.6 _{4 g}	1.57 _{9 x}	—
	L ₅	0.25 _{5 c}	0.10 _{1 i}	0.10 _{8 i}	0.17 _{0 i}	5.54 _{4 i}	0.07 _{0 i}	0.00 _{8 a}	0.00 _{4 a}	0.00 _{9 c}	0.00 _{4 i}	93.6 _{0 g}	1.57 _{3 i}	—
	L ₆	0.27 _{8 c}	0.10 _{6 a}	0.10 _{1 c}	0.16 _{8 c}	5.57 _{7 a}	0.06 _{4 a}	0.00 _{4 a}	0.00 _{0 a}	0.00 _{9 c}	0.00 _{0 a}	93.7 _{1 g}	1.59 _{2 x}	—
	L ₇	0.26 _{9 c}	0.12 _{9 i}	0.10 _{0 c}	0.16 _{8 c}	5.60 _{4 i}	0.06 _{2 i}	0.00 _{4 a}	0.00 _{0 a}	0.00 _{3 c}	0.00 _{2 a}	93.7 _{3 g}	1.61 _{8 i}	—
	L ₈	0.25 _{8 c}	0.12 _{6 a}	0.11 _{3 c}	0.16 _{4 c}	5.75 _{8 a}	0.07 _{1 a}	0.00 _{2 a}	0.00 _{1 a}	0.00 _{5 c}	0.00 _{4 c}	93.5 _{8 g}	1.57 _{5 x}	—
	L ₉	0.28 _{0 c}	0.12 _{4 a}	0.09 _{4 c}	0.16 _{7 c}	5.52 _{8 a}	0.06 _{5 a}	0.00 _{0 a}	0.00 _{0 a}	0.01 _{2 c}	0.00 _{4 a}	93.9 _{4 g}	1.62 _{1 x}	—
Average (\bar{X})		0.263 ₃	0.119 ₁	0.100 ₆	0.167 ₆	5.585 ₇	0.063 ₆	0.004 ₂	0.001 ₉	0.007 ₂	0.003 ₁	93.67 ₇	1.592 ₂	92.08 ₅
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.013 ₀	0.017 ₂	0.007 ₁	0.001 ₇	0.036 ₇	0.005 ₄	0.002 ₅	0.001 ₉	0.002 ₇	0.001 ₀	0.15 ₈	0.019 ₂	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.007 ₇	0.010 ₂	0.002 ₂	0.003 ₈	0.020 ₇	0.004 ₁	0.000 ₉	0.001 ₆	0.001 ₀	0.001 ₇	0.08 ₀	0.014 ₃	—
Uncertainty C (95%) *2		0.01 ₀	0.01 ₃	0.00 ₅	0.00 ₁	0.02 ₈	0.00 ₄	0.00 ₂	0.00 ₁	0.00 ₂	0.00 ₁	0.1 ₂	0.01 ₅	0.1 ₂ *4

(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)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{\bar{x}_{ZrO_2}} = \sqrt{(s_{\bar{x}_{ZrO_2}(HfO_2)})^2 + (s_{\bar{x}_{HfO_2}})^2}$

- (1) List of laboratories : Krosaki Corporation, 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., Toshiba Monofrax Co.,Ltd.
- (2) Analytical techniques : JIS R 2012(Method for chemical analysis of refractory containing zircon and/or zirconia) a; AAS, c;colorimetry, g;gravimetry, G;gravimetry and colorimetry, i;ICP-AES, v;chelatometry, x;XRF
- (3) 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.
- (4) 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.
- (5) Date of preparation : March, 1995

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories
J R R M 6 0 2 (Zircon-Zirconia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value	0.33 ₅	0.07 ₈	1.62 ₂	0.16 ₄	0.22 ₁	5.30 ₄	0.76 ₈	0.00 ₄	1.34 ₂	0.01 ₅	90.0 ₀	1.52 ₆	88.4 ₈
Laboratories													
L ₁	0.33 _{1 x}	0.08 _{6 i}	1.63 _{2 i}	0.15 _{7 i}	0.23 _{9 i}	5.33 _{5 i}	0.78 _{7 a}	0.00 _{4 a}	1.33 _{2 c}	0.01 _{8 i}	90.0 _{6 g}	1.51 _{4 x}	—
L ₂	0.34 _{4 i}	0.08 _{2 i}	1.63 _{3 c}	0.16 _{0 i}	0.21 _{0 i}	5.34 _{8 i}	0.76 _{0 a}	0.00 _{4 a}	1.33 _{5 c}	0.00 _{8 i}	89.5 _{6 g}	1.48 _{5 i}	—
L ₃	0.34 _{9 i}	0.06 _{6 i}	1.64 _{0 c}	0.16 _{9 i}	0.21 _{2 i}	5.27 _{6 i}	0.74 _{0 a}	0.00 _{4 a}	1.33 _{9 c}	0.01 _{3 i}	89.1 _{3 g}	1.52 _{5 x}	—
L ₄	0.31 _{1 x}	0.07 _{9 a}	1.60 _{2 c}	0.17 _{4 c}	0.23 _{9 a}	5.25 _{7 a}	0.76 _{6 a}	0.00 _{3 a}	1.33 _{2 c}	0.02 _{4 a}	89.9 _{3 g}	1.52 _{6 x}	—
L ₅	0.32 _{5 i}	0.04 _{5 i}	1.61 _{1 i}	0.15 _{8 i}	0.24 _{2 i}	5.28 _{0 i}	0.81 _{3 a}	0.00 _{6 a}	1.35 _{0 c}	0.00 _{4 i}	89.0 _{2 g}	1.52 _{0 x}	—
L ₆	0.34 _{2 x}	0.09 _{2 a}	1.60 _{1 c}	0.16 _{6 c}	0.19 _{5 a}	5.23 _{3 a}	0.71 _{8 a}	0.00 _{4 a}	1.34 _{5 c}	0.02 _{0 a}	89.1 _{5 g}	1.53 _{9 x}	—
L ₇	0.35 _{1 i}	0.08 _{4 i}	1.63 _{5 c}	0.16 _{6 c}	0.23 _{8 i}	5.34 _{9 i}	0.77 _{7 a}	0.00 _{4 a}	1.36 _{3 c}	0.02 _{0 i}	89.9 _{3 g}	1.54 _{9 i}	—
L ₈	0.33 _{1 x}	0.07 _{2 a}	1.61 _{7 c}	0.16 _{0 c}	0.20 _{1 a}	5.35 _{7 a}	0.77 _{4 a}	0.00 _{2 a}	1.35 _{4 c}	0.01 _{4 a}	89.2 _{2 g}	1.50 _{2 x}	—
L ₉	0.33 _{5 x}	0.09 _{4 a}	1.62 _{4 c}	0.16 _{6 c}	0.21 _{4 a}	5.29 _{7 a}	0.77 _{4 a}	0.00 _{1 a}	1.32 _{5 c}	0.01 _{6 a}	90.0 _{1 g}	1.57 _{0 x}	—
Average (\bar{X})	0.335 ₄	0.077 ₈	1.621 ₇	0.164 ₀	0.221 ₁	5.303 ₆	0.767 ₇	0.003 ₈	1.341 ₇	0.015 ₂	90.00 ₁	1.525 ₆	88.47 ₅
Standard deviation (Reproducibility) s_x	0.012 ₈	0.015 ₀	0.014 ₆	0.005 ₆	0.018 ₃	0.044 ₉	0.027 ₁	0.001 ₄	0.012 ₃	0.006 ₄	0.18 ₃	0.025 ₄	—
Standard deviation (Reproducibility without laboratories) $s_{I(T)}$ *1	0.004 ₇	0.004 ₁	0.015 ₅	0.004 ₉	0.007 ₃	0.026 ₇	0.014 ₂	0.000 ₈	0.026 ₃	0.002 ₉	0.08 ₄	0.011 ₂	—
Uncertainty C (95%) *2	0.01 ₀	0.01 ₂	0.01 ₁	0.00 ₄	0.01 ₄	0.03 ₅	0.02 ₁	0.00 ₁	0.00 ₉	0.00 ₅	0.1 ₄	0.02 ₀	0.1 ₄ *4

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

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{x_{ZrO_2}} = \sqrt{(s_{x_{ZrO_2}(HfO_2)}}^2 + (s_{x_{HfO_2}})^2}$

- (1) List of laboratories : Krosaki Corporation, 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., Toshiba Monofrax Co.,Ltd.
- (2) Analytical techniques : JIS R 2012(Method for chemical analysis of refractory containing zircon and/or zirconia) a: AAS, c:colorimetry, g:gravimetry, G:gravimetry and colorimetry, i:ICP-AES, v:chelatometry, x:XRF
- (3) 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.
- (4) 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.
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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories
J R R M 6 0 3 (Zircon-Zirconia Refractory)
Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		0.96 ₇	5.29 ₉	2.86 ₁	0.93 ₄	0.95 ₄	0.96 ₈	0.18 ₇	0.65 ₃	0.83 ₈	0.02 ₉	86.2 ₆	1.45 ₄	84.8 ₀
Laboratories	L ₁	0.96 _{7 x}	5.40 _{0 i}	2.85 _{5 i}	0.90 _{2 i}	0.96 _{9 i}	0.98 _{5 i}	0.18 _{4 a}	0.65 _{4 a}	0.82 _{9 c}	0.03 _{2 i}	86.5 _{0 g}	1.44 _{6 x}	—
	L ₂	0.96 _{9 i}	5.40 _{6 i}	2.87 _{0 c}	0.93 _{3 i}	0.93 _{6 i}	0.94 _{7 i}	0.19 _{2 a}	0.63 _{7 a}	0.85 _{1 c}	0.01 _{8 i}	86.0 _{0 g}	1.45 _{2 x}	—
	L ₃	0.98 _{5 i}	5.23 _{1 i}	2.92 _{1 c}	0.93 _{6 i}	0.95 _{8 i}	0.98 _{0 i}	0.18 _{0 a}	0.63 _{7 a}	0.81 _{4 c}	0.04 _{6 i}	86.1 _{0 g}	1.45 _{8 x}	—
	L ₄	0.97 _{1 x}	5.27 _{0 a}	2.86 _{5 c}	0.95 _{3 c}	0.96 _{8 a}	0.94 _{3 a}	0.19 _{0 a}	0.66 _{3 a}	0.85 _{2 c}	0.03 _{1 a}	86.2 _{1 g}	1.44 _{8 x}	—
	L ₅	0.95 _{6 i}	5.29 _{8 i}	2.81 _{3 i}	0.93 _{3 i}	0.94 _{9 i}	0.96 _{7 i}	0.20 _{4 a}	0.66 _{7 a}	0.84 _{0 c}	0.01 _{8 i}	86.4 _{3 g}	1.43 _{6 i}	—
	L ₆	0.95 _{5 x}	5.24 _{1 a}	2.88 _{2 c}	0.95 _{4 c}	0.92 _{5 a}	0.95 _{6 a}	0.18 _{3 a}	0.65 _{7 a}	0.84 _{3 c}	0.01 _{6 a}	86.4 _{2 g}	1.46 _{6 x}	—
	L ₇	0.98 _{1 i}	5.34 _{5 v}	2.85 _{8 c}	0.94 _{9 c}	0.96 _{3 i}	0.97 _{1 i}	0.18 _{2 a}	0.66 _{2 a}	0.83 _{7 c}	0.03 _{4 i}	85.9 _{7 g}	1.46 _{4 x}	—
	L ₈	0.95 _{6 x}	5.27 _{6 a}	2.82 _{7 c}	0.92 _{0 c}	0.96 _{8 a}	0.98 _{9 a}	0.18 _{8 a}	0.64 _{3 a}	0.84 _{7 c}	0.04 _{1 a}	86.3 _{4 g}	1.43 _{2 x}	—
	L ₉	0.96 _{4 x}	5.22 _{7 a}	2.86 _{2 c}	0.92 _{2 c}	0.94 _{7 a}	0.97 _{5 a}	0.18 _{3 a}	0.65 _{9 a}	0.83 _{3 c}	0.02 _{2 a}	86.3 _{5 g}	1.48 _{8 x}	—
Average (\bar{X})		0.967 ₁	5.299 ₃	2.861 ₄	0.933 ₆	0.953 ₇	0.968 ₁	0.187 ₃	0.653 ₂	0.838 ₄	0.028 ₇	86.25 ₈	1.454 ₄	84.80 ₄
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.010 ₅	0.069 ₉	0.030 ₆	0.017 ₂	0.015 ₈	0.016 ₄	0.007 ₂	0.011 ₈	0.012 ₀	0.010 ₅	0.19 ₈	0.017 ₁	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.005 ₂	0.047 ₂	0.023 ₀	0.008 ₆	0.007 ₆	0.013 ₃	0.003 ₄	0.012 ₆	0.008 ₁	0.002 ₃	0.11 ₁	0.003 ₄	—
Uncertainty C (95%) *2		0.00 ₈	0.05 ₄	0.02 ₄	0.01 ₃	0.01 ₂	0.01 ₃	0.00 ₆	0.00 ₉	0.00 ₉	0.00 ₈	0.1 ₅	0.01 ₃	0.1 ₅ *4

(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)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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- (3) 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.
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Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		3.05 ₂	6.93 ₃	0.43 ₀	0.13 ₄	0.09 ₄	0.01 ₇	1.09 ₀	1.94 ₂	1.99 ₇	3.06 ₉	80.8 ₁	1.35 ₉	79.4 ₅
Laboratories	L ₁	3.04 _{1 x}	7.00 _{9 i}	0.43 _{1 i}	0.13 _{2 i}	0.09 _{8 i}	0.01 _{8 i}	1.10 _{7 a}	1.98 _{3 a}	1.99 _{1 c}	3.07 _{7 i}	80.8 _{7 g}	1.37 _{0 x}	—
	L ₂	3.02 _{7 i}	6.98 _{5 i}	0.41 _{9 c}	0.13 _{1 i}	0.09 _{2 i}	0.01 _{5 i}	1.05 _{0 a}	1.91 _{4 a}	2.04 _{1 c}	3.02 _{1 i}	80.7 _{4 g}	1.36 _{7 x}	—
	L ₃	3.04 _{8 i}	6.98 _{2 i}	0.43 _{7 c}	0.13 _{6 i}	0.11 _{6 i}	0.01 _{7 i}	1.06 _{7 a}	1.90 _{2 a}	1.95 _{4 c}	3.11 _{2 i}	80.7 _{7 g}	1.34 _{1 i}	—
	L ₄	3.09 _{5 x}	6.87 _{4 a}	0.42 _{9 c}	0.13 _{4 c}	0.08 _{9 a}	0.01 _{8 a}	1.10 _{4 a}	1.92 _{3 a}	1.98 _{2 c}	3.07 _{4 a}	80.7 _{3 g}	1.36 _{1 x}	—
	L ₅	2.99 _{9 i}	6.85 _{4 i}	0.42 _{8 i}	0.12 _{8 i}	0.10 _{0 i}	0.02 _{0 i}	1.13 _{9 a}	1.94 _{7 a}	2.05 _{1 c}	3.04 _{1 i}	80.9 _{8 g}	1.29 _{4 i}	—
	L ₆	3.07 _{9 x}	6.95 _{8 a}	0.43 _{2 c}	0.13 _{2 c}	0.08 _{0 a}	0.01 _{2 a}	1.07 _{2 a}	1.96 _{2 a}	1.99 _{4 c}	3.07 _{2 a}	80.5 _{8 g}	1.38 _{3 x}	—
	L ₇	3.07 _{4 i}	6.96 _{0 v}	0.42 _{8 c}	0.13 _{7 c}	0.09 _{5 i}	0.01 _{6 i}	1.04 _{4 a}	1.97 _{2 a}	2.00 _{2 c}	3.05 _{2 i}	80.9 _{3 g}	1.36 _{7 x}	—
	L ₈	3.04 _{3 x}	6.95 _{4 a}	0.42 _{9 c}	0.13 _{4 c}	0.08 _{6 a}	0.01 _{9 a}	1.12 _{3 a}	1.93 _{7 a}	1.97 _{5 c}	3.08 _{8 a}	80.9 _{6 g}	1.34 _{5 x}	—
	L ₉	3.05 _{9 x}	6.82 _{2 a}	0.43 _{3 c}	0.13 _{8 c}	0.09 _{0 a}	0.01 _{5 a}	1.10 _{5 a}	1.93 _{6 a}	1.98 _{5 c}	3.08 _{2 a}	80.7 _{1 g}	1.40 _{5 x}	—
Average (\bar{X})		3.051 ₇	6.933 ₁	0.429 ₆	0.133 ₆	0.094 ₀	0.016 ₇	1.090 ₁	1.941 ₈	1.997 ₂	3.068 ₈	80.80 ₈	1.359 ₂	79.44 ₉
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.029 ₂	0.066 ₄	0.004 ₇	0.003 ₀	0.010 ₁	0.002 ₄	0.032 ₈	0.027 ₀	0.030 ₉	0.026 ₈	0.13 ₂	0.030 ₉	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.023 ₈	0.036 ₈	0.004 ₈	0.002 ₆	0.012 ₅	0.002 ₇	0.022 ₇	0.019 ₂	0.018 ₈	0.022 ₀	0.07 ₇	0.010 ₄	—
Uncertainty C (95%) *2		0.02 ₂	0.05 ₁	0.00 ₄	0.00 ₂	0.00 ₈	0.00 ₂	0.02 ₅	0.02 ₁	0.02 ₄	0.02 ₁	0.1 ₀	0.02 ₄	0.1 ₀ *4

(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)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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- (5) Date of preparation : March, 1995

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories
J R R M 6 0 5 (Zircon-Zirconia Refractory)
Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		10.8 ₂	4.84 ₇	0.17 ₇	0.12 ₇	1.94 ₅	1.99 ₉	0.45 ₈	0.54 ₃	0.35 ₄	1.55 ₃	76.9 ₁	1.31 ₈	75.5 ₉
Laboratories	L ₁	10.7 _{7 G}	4.93 _{9 i}	0.17 _{9 i}	0.12 _{8 i}	1.94 _{8 i}	1.98 _{4 i}	0.46 _{0 a}	0.55 _{4 a}	0.36 _{1 c}	1.57 _{3 i}	76.9 _{5 g}	1.30 _{7 x}	—
	L ₂	10.8 _{4 G}	4.89 _{2 i}	0.17 _{9 c}	0.12 _{8 i}	1.95 _{9 i}	1.99 _{2 i}	0.47 _{4 a}	0.54 _{2 a}	0.34 _{1 c}	1.55 _{5 i}	76.7 _{6 g}	1.38 _{6 i}	—
	L ₃	10.9 _{0 G}	4.83 _{3 i}	0.17 _{5 c}	0.12 _{6 i}	1.93 _{5 i}	1.94 _{3 i}	0.44 _{3 a}	0.53 _{4 a}	0.34 _{5 c}	1.51 _{9 i}	76.7 _{5 g}	1.28 _{5 i}	—
	L ₄	10.7 _{6 G}	4.80 _{4 a}	0.17 _{8 c}	0.12 _{9 c}	1.95 _{4 a}	1.99 _{5 a}	0.45 _{3 a}	0.52 _{7 a}	0.35 _{8 c}	1.56 _{1 a}	76.9 _{3 g}	1.29 _{1 x}	—
	L ₅	10.9 _{1 G}	4.90 _{8 i}	0.18 _{2 i}	0.12 _{9 i}	1.93 _{8 i}	2.04 _{6 i}	0.48 _{7 a}	0.56 _{7 a}	0.35 _{4 c}	1.57 _{4 i}	77.0 _{2 g}	1.28 _{8 i}	—
	L ₆	10.8 _{3 G}	4.83 _{1 a}	0.17 _{4 a}	0.12 _{6 c}	1.94 _{0 a}	1.99 _{3 a}	0.45 _{1 a}	0.53 _{3 a}	0.35 _{3 c}	1.52 _{6 a}	76.7 _{8 g}	1.31 _{5 x}	—
	L ₇	10.6 _{5 G}	4.87 _{1 i}	0.17 _{5 c}	0.12 _{8 c}	1.95 _{5 i}	1.99 _{5 i}	0.44 _{9 a}	0.54 _{8 a}	0.35 _{7 c}	1.54 _{7 i}	77.1 _{9 g}	1.31 _{0 x}	—
	L ₈	10.7 _{4 G}	4.78 _{1 a}	0.17 _{9 c}	0.12 _{8 c}	1.96 _{9 a}	2.01 _{5 a}	0.47 _{4 a}	0.54 _{2 a}	0.35 _{3 c}	1.53 _{5 a}	76.8 _{2 g}	1.33 _{3 i}	—
	L ₉	10.9 _{4 G}	4.76 _{8 a}	0.17 _{1 c}	0.12 _{4 c}	1.90 _{7 a}	2.02 _{8 a}	0.43 _{4 a}	0.53 _{6 a}	0.36 _{7 c}	1.58 _{3 a}	77.0 _{0 g}	1.34 _{5 x}	—
Average (\bar{X})		10.81 ₆	4.847 ₄	0.176 ₉	0.127 ₃	1.945 ₃	1.999 ₃	0.458 ₃	0.542 ₆	0.354 ₃	1.552 ₆	76.91 ₁	1.317 ₈	75.59 ₃
Standard deviation	(Reproducibility) s_x	0.09 ₂	0.059 ₄	0.003 ₃	0.001 ₇	0.018 ₄	0.028 ₉	0.016 ₈	0.012 ₂	0.007 ₈	0.022 ₃	0.14 ₉	0.032 ₆	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.05 ₅	0.035 ₂	0.006 ₀	0.002 ₀	0.017 ₈	0.012 ₅	0.005 ₆	0.013 ₄	0.010 ₅	0.017 ₀	0.12 ₈	0.013 ₄	—
Uncertainty C (95%) **2		0.0 ₇	0.04 ₆	0.00 ₃	0.00 ₁	0.01 ₄	0.02 ₂	0.01 ₃	0.00 ₉	0.00 ₆	0.01 ₇	0.1 ₁	0.02 ₅	0.1 ₂ *4

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition.

* 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_x / \sqrt{\ell}$ (ℓ = number of laboratories)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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J R R M 6 0 6 (Zircon-Zirconia Refractory)
Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		22.1 ₀	0.53 ₄	0.93 ₆	0.11 ₇	0.02 ₁	0.32 ₁	2.03 ₄	0.01 ₄	0.01 ₉	0.00 ₈	73.8 ₆	1.26 ₉	72.5 ₉
Laboratories	L ₁	22.0 ₃ G	0.52 ₅ i	0.94 ₇ i	0.12 ₀ i	0.02 ₀ i	0.33 ₉ i	1.99 ₃ a	0.01 ₉ a	0.01 ₈ c	0.01 ₀ i	73.8 ₅ g	1.26 ₂ x	—
	L ₂	22.1 ₉ G	0.53 ₂ i	0.93 ₅ c	0.11 ₈ i	0.02 ₀ i	0.30 ₉ i	2.05 ₅ a	0.01 ₈ a	0.02 ₀ c	0.00 ₃ i	73.8 ₂ g	1.29 ₁ i	—
	L ₃	22.0 ₅ G	0.53 ₄ i	0.93 ₂ c	0.11 ₈ c	0.01 ₈ i	0.30 ₃ i	2.04 ₂ a	0.01 ₂ a	0.01 ₈ c	0.01 ₀ i	73.8 ₈ g	1.22 ₅ i	—
	L ₄	22.1 ₂ G	0.54 ₄ a	0.92 ₇ c	0.12 ₁ c	0.02 ₀ a	0.31 ₉ a	2.01 ₉ a	0.01 ₂ a	0.02 ₁ c	0.01 ₂ a	73.8 ₂ g	1.23 ₂ x	—
	L ₅	21.9 ₃ G	0.52 ₈ i	0.94 ₇ i	0.11 ₉ i	0.02 ₈ i	0.34 ₁ i	2.03 ₀ a	0.01 ₉ a	0.02 ₀ c	0.00 ₃ i	73.8 ₇ g	1.25 ₃ i	—
	L ₆	22.3 ₄ G	0.53 ₉ a	0.92 ₄ c	0.11 ₁ c	0.02 ₂ a	0.31 ₉ a	2.03 ₆ a	0.01 ₀ a	0.01 ₈ c	0.01 ₁ a	73.8 ₉ g	1.27 ₃ x	—
	L ₇	22.0 ₁ G	0.54 ₄ v	0.92 ₈ c	0.11 ₈ c	0.02 ₀ i	0.31 ₉ i	2.05 ₃ a	0.01 ₂ a	0.01 ₈ c	0.00 ₈ i	73.7 ₇ g	1.30 ₄ i	—
	L ₈	22.2 ₁ G	0.51 ₂ a	0.93 ₅ c	0.11 ₈ c	0.01 ₆ a	0.32 ₉ a	2.05 ₁ a	0.01 ₂ a	0.02 ₀ c	0.00 ₉ a	73.7 ₄ g	1.28 ₇ i	—
	L ₉	22.0 ₀ G	0.54 ₅ a	0.94 ₈ c	0.11 ₄ c	0.02 ₄ a	0.31 ₅ a	2.02 ₉ a	0.01 ₀ a	0.02 ₀ c	0.00 ₇ a	74.0 ₉ g	1.29 ₅ x	—
Average (\bar{X})		22.09 ₈	0.533 ₇	0.935 ₉	0.117 ₄	0.020 ₉	0.321 ₄	2.034 ₂	0.013 ₈	0.019 ₂	0.008 ₁	73.85 ₉	1.269 ₁	72.59 ₆
Standard deviation	(Reproducibility) $s_{\bar{x}}$	0.13 ₀	0.011 ₀	0.009 ₂	0.003 ₁	0.003 ₆	0.012 ₈	0.019 ₆	0.003 ₉	0.001 ₁	0.003 ₃	0.09 ₇	0.028 ₂	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.05 ₁	0.011 ₁	0.009 ₈	0.002 ₄	0.001 ₇	0.006 ₄	0.014 ₂	0.002 ₀	0.001 ₂	0.001 ₄	0.08 ₆	0.008 ₃	—
Uncertainty C (95%) *2		0.1 ₀	0.00 ₈	0.00 ₇	0.00 ₂	0.00 ₃	0.01 ₀	0.01 ₅	0.00 ₃	0.00 ₁	0.00 ₃	0.0 ₇	0.02 ₂	0.0 ₈ *4

(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)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{x_{ZrO_2}} = \sqrt{(s_{x_{ZrO_2}(HfO_2)}}^2 + (s_{x_{HfO_2}})^2}$

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Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value	32.9 ₄	3.53 ₉	0.12 ₁	0.13 ₇	0.04 ₈	0.03 ₁	0.02 ₆	0.04 ₃	0.08 ₆	0.00 ₂	62.8 ₈	1.21 ₈	61.6 ₆
Laboratories													
L ₁	33.0 ₂ g	3.50 ₈ i	0.11 ₅ i	0.14 ₃ c	0.04 ₈ i	0.02 ₉ i	0.03 ₁ a	0.04 ₆ a	0.08 ₃ c	0.00 ₀ i	62.6 ₁ g	1.20 ₈ x	—
L ₂	32.9 ₇ g	3.55 ₁ i	0.11 ₂ c	0.13 ₇ i	0.04 ₆ i	0.02 ₈ i	0.02 ₈ a	0.04 ₆ a	0.08 ₉ c	0.00 ₀ i	62.6 ₈ g	1.23 ₀ i	—
L ₃	33.0 ₀ g	3.53 ₉ i	0.12 ₁ c	0.13 ₇ i	0.04 ₆ i	0.02 ₆ i	0.03 ₀ a	0.04 ₀ a	0.08 ₂ c	0.00 ₁ i	63.0 ₀ g	1.20 ₀ i	—
L ₄	32.9 ₁ g	3.50 ₈ a	0.12 ₇ c	0.13 ₈ c	0.05 ₀ a	0.03 ₅ a	0.02 ₇ a	0.04 ₄ a	0.08 ₃ c	0.00 ₂ a	62.7 ₈ g	1.19 ₆ x	—
L ₅	32.9 ₄ g	3.53 ₁ i	0.12 ₅ i	0.13 ₉ i	0.04 ₄ i	0.03 ₆ i	0.02 ₈ a	0.04 ₅ a	0.08 ₂ c	0.00 ₃ i	62.7 ₇ g	1.22 ₃ i	—
L ₆	32.9 ₇ g	3.56 ₀ v	0.12 ₅ c	0.13 ₅ c	0.05 ₀ a	0.02 ₆ a	0.02 ₃ a	0.04 ₀ a	0.09 ₀ c	0.00 ₀ a	62.1 ₀ g	1.22 ₀ x	—
L ₇	32.8 ₁ g	3.56 ₈ v	0.11 ₆ c	0.13 ₂ c	0.04 ₈ i	0.03 ₁ i	0.02 ₆ a	0.04 ₄ a	0.08 ₄ c	0.00 ₂ a	63.0 ₀ g	1.21 ₂ i	—
L ₈	32.8 ₁ g	3.54 ₅ a	0.12 ₇ c	0.13 ₇ c	0.05 ₀ a	0.03 ₀ a	0.02 ₀ a	0.04 ₁ a	0.08 ₇ c	0.00 ₅ a	62.8 ₉ g	1.23 ₁ i	—
L ₉	33.0 ₃ g	3.53 ₉ a	0.12 ₄ c	0.13 ₂ c	0.05 ₄ a	0.03 ₁ a	0.02 ₃ a	0.04 ₂ a	0.09 ₁ c	0.00 ₄ a	63.1 ₁ g	1.24 ₄ x	—
Average (\bar{X})	32.94 ₀	3.538 ₈	0.121 ₃	0.136 ₇	0.048 ₄	0.031 ₀	0.026 ₂	0.043 ₁	0.085 ₇	0.001 ₉	62.88 ₂	1.218 ₂	61.66 ₄
Standard deviation (Reproducibility) s_x	0.07 ₇	0.022 ₀	0.005 ₈	0.003 ₃	0.003 ₁	0.004 ₃	0.003 ₆	0.002 ₈	0.003 ₈	0.001 ₈	0.19 ₃	0.015 ₇	—
Standard deviation (Reproducibility without laboratories) $s_{I(T)}$ *1	0.04 ₇	0.048 ₃	0.003 ₀	0.001 ₆	0.001 ₆	0.003 ₇	0.002 ₃	0.003 ₅	0.002 ₃	0.001 ₃	0.10 ₇	0.013 ₆	—
Uncertainty C (95%) *2	0.0 ₆	0.01 ₇	0.00 ₄	0.00 ₃	0.00 ₂	0.00 ₃	0.00 ₃	0.00 ₂	0.00 ₃	0.00 ₁	0.1 ₅	0.01 ₂	0.1 ₅ *4

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

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$ * 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		34.6 ₅	0.70 ₇	0.09 ₂	0.10 ₂	0.52 ₁	3.12 ₇	0.03 ₁	0.01 ₉	0.11 ₇	0.49 ₇	60.1 ₀	1.21 ₇	58.8 ₈
Laboratories	L ₁	34.6 ₁ g	0.75 ₂ i	0.10 ₄ i	0.10 ₂ i	0.54 ₂ i	3.13 ₉ i	0.03 ₂ a	0.01 ₉ a	0.10 ₅ c	0.50 ₄ i	59.9 ₇ g	1.21 ₆ x	—
	L ₂	34.6 ₈ g	0.66 ₇ i	0.08 ₂ c	0.10 ₀ i	0.51 ₂ i	3.11 ₈ i	0.03 ₄ a	0.02 ₂ a	0.12 ₄ c	0.47 ₂ i	60.0 ₇ g	1.20 ₇ x	—
	L ₃	34.7 ₃ g	0.71 ₃ i	0.09 ₁ c	0.10 ₀ c	0.51 ₉ i	3.11 ₆ i	0.03 ₂ a	0.01 ₅ a	0.11 ₆ c	0.48 ₇ i	59.8 ₂ g	1.19 ₆ i	—
	L ₄	34.6 ₀ g	0.70 ₈ a	0.09 ₉ c	0.10 ₄ c	0.52 ₇ a	3.10 ₆ a	0.03 ₃ a	0.02 ₂ a	0.11 ₂ c	0.49 ₄ a	60.2 ₆ g	1.19 ₁ x	—
	L ₅	34.6 ₆ g	0.67 ₃ a	0.09 ₄ c	0.10 ₀ c	0.51 ₂ i	3.14 ₈ i	0.03 ₆ a	0.02 ₄ a	0.11 ₇ c	0.49 ₆ i	60.2 ₅ g	1.21 ₇ i	—
	L ₆	34.7 ₁ g	0.74 ₄ a	0.09 ₀ c	0.10 ₀ c	0.51 ₆ a	3.10 ₆ a	0.02 ₈ a	0.01 ₅ a	0.12 ₄ c	0.51 ₀ a	60.1 ₀ g	1.21 ₄ x	—
	L ₇	34.5 ₂ g	0.69 ₆ i	0.08 ₆ c	0.10 ₆ c	0.53 ₅ i	3.13 ₀ i	0.03 ₁ a	0.02 ₀ a	0.12 ₀ c	0.51 ₆ i	60.1 ₉ g	1.25 ₈ i	—
	L ₈	34.4 ₈ g	0.72 ₄ a	0.08 ₈ c	0.10 ₂ c	0.51 ₂ a	3.11 ₂ a	0.02 ₅ a	0.01 ₈ a	0.11 ₃ c	0.49 ₄ a	60.0 ₉ g	1.22 ₇ i	—
	L ₉	34.8 ₂ g	0.68 ₇ a	0.09 ₂ c	0.10 ₈ c	0.51 ₂ a	3.17 ₁ a	0.02 ₆ a	0.01 ₆ a	0.12 ₆ c	0.49 ₉ a	60.1 ₆ g	1.23 ₁ x	—
Average (\bar{X})		34.64 ₆	0.707 ₁	0.091 ₈	0.102 ₄	0.520 ₈	3.127 ₃	0.030 ₈	0.019 ₀	0.117 ₄	0.496 ₉	60.10 ₁	1.217 ₄	58.88 ₄
Standard deviation	(Reproducibility) s_x	0.09 ₉	0.029 ₉	0.006 ₆	0.003 ₂	0.011 ₂	0.021 ₈	0.003 ₇	0.003 ₄	0.006 ₇	0.012 ₉	0.15 ₂	0.020 ₀	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.06 ₀	0.009 ₇	0.006 ₁	0.003 ₄	0.009 ₀	0.018 ₇	0.002 ₄	0.002 ₀	0.004 ₆	0.016 ₆	0.07 ₂	0.012 ₀	—
Uncertainty C (95%) *2		0.0 ₈	0.02 ₃	0.00 ₅	0.00 ₂	0.00 ₉	0.01 ₇	0.00 ₃	0.00 ₃	0.00 ₅	0.01 ₀	0.1 ₂	0.01 ₅	0.1 ₂ *4

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition.

* 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_x / \sqrt{\ell}$ (ℓ = number of laboratories)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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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 6 0 9 (Zircon-Zirconia Refractory)
Results of Analyses

		Unit : mass%												
Constituent		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value		40.5 ₅	0.88 ₇	0.15 ₀	0.15 ₃	0.30 ₀	0.15 ₀	0.94 ₃	0.02 ₈	0.08 ₁	0.01 ₂	56.7 ₅	1.12 ₄	55.6 ₂
Laboratories	L ₁	40.4 ₃ G	0.88 ₆ i	0.15 ₆ i	0.15 ₃ i	0.31 ₄ i	0.15 ₂ i	0.94 ₃ a	0.02 ₆ a	0.08 ₀ c	0.01 ₂ i	56.5 ₉ g	1.12 ₁ x	—
	L ₂	40.6 ₃ G	0.88 ₁ i	0.14 ₆ c	0.15 ₁ i	0.31 ₀ i	0.14 ₈ i	0.95 ₇ a	0.03 ₈ a	0.08 ₁ c	0.01 ₂ i	56.6 ₆ g	1.13 ₇ i	—
	L ₃	40.5 ₈ G	0.90 ₀ i	0.14 ₆ c	0.15 ₂ c	0.29 ₂ i	0.14 ₅ i	0.93 ₉ a	0.02 ₆ a	0.07 ₈ c	0.01 ₁ i	56.6 ₇ g	1.09 ₂ i	—
	L ₄	40.6 ₁ G	0.88 ₉ a	0.14 ₄ c	0.15 ₆ c	0.30 ₀ a	0.14 ₆ a	0.94 ₁ a	0.03 ₀ a	0.08 ₀ c	0.01 ₀ a	56.7 ₄ g	1.08 ₉ x	—
	L ₅	40.6 ₁ G	0.88 ₈ i	0.15 ₃ i	0.15 ₄ i	0.29 ₄ i	0.15 ₁ i	0.93 ₈ a	0.03 ₂ a	0.08 ₁ c	0.00 ₆ i	56.6 ₅ g	1.12 ₃ i	—
	L ₆	40.4 ₉ G	0.89 ₀ a	0.14 ₉ c	0.15 ₅ c	0.29 ₄ a	0.15 ₉ a	0.93 ₃ a	0.02 ₂ a	0.08 ₁ c	0.01 ₈ a	56.8 ₉ g	1.12 ₁ x	—
	L ₇	40.3 ₆ G	0.87 ₈ i	0.14 ₈ c	0.15 ₅ c	0.30 ₂ i	0.14 ₉ i	0.93 ₁ a	0.02 ₆ a	0.07 ₈ c	0.01 ₂ i	56.7 ₉ g	1.17 ₁ i	—
	L ₈	40.4 ₈ G	0.87 ₇ a	0.15 ₂ c	0.15 ₂ c	0.30 ₂ a	0.15 ₀ a	0.95 ₅ a	0.02 ₈ a	0.08 ₀ c	0.01 ₆ a	57.0 ₀ g	1.13 ₁ i	—
	L ₉	40.7 ₇ G	0.89 ₁ a	0.15 ₃ c	0.15 ₀ c	0.29 ₆ a	0.14 ₇ a	0.94 ₉ a	0.02 ₈ a	0.08 ₂ c	0.00 ₉ a	56.7 ₄ g	1.12 ₈ x	—
Average (\bar{x})		40.55 ₁	0.886 ₇	0.149 ₇	0.153 ₁	0.300 ₄	0.149 ₇	0.942 ₉	0.028 ₄	0.080 ₈	0.011 ₈	56.74 ₈	1.123 ₇	55.62 ₄
Standard deviation	(Reproducibility) s_x	0.11 ₂	0.006 ₇	0.004 ₂	0.002 ₀	0.007 ₇	0.004 ₂	0.009 ₁	0.004 ₅	0.002 ₁	0.003 ₄	0.13 ₂	0.024 ₄	—
	(Reproducibility without laboratories) $s_{I(T)}$ *1	0.04 ₅	0.009 ₂	0.004 ₂	0.003 ₀	0.006 ₂	0.003 ₀	0.007 ₁	0.002 ₃	0.001 ₄	0.002 ₀	0.11 ₅	0.005 ₅	—
Uncertainty C (95%) *2		0.0 ₉	0.00 ₅	0.00 ₃	0.00 ₂	0.00 ₆	0.00 ₃	0.00 ₇	0.00 ₃	0.00 ₂	0.00 ₃	0.1 ₀	0.01 ₉	0.1 ₀ *4

(Note) * 1 $s_{I(T)}$ is intermediate precision without a time condition.

* 2 The half-width confidence interval C (95%) = $t_{\ell-1,0.05} \times s_x / \sqrt{\ell}$ (ℓ = number of laboratories)

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$

* 4 $s_{x_{ZrO_2}} = \sqrt{(s_{x_{ZrO_2}(HfO_2)}}^2 + (s_{x_{HfO_2}})^2}$

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Certified Reference Material Series for X-ray Fluorescence Analysis of Refractories
J R R M 6 1 0 (Zircon-Zirconia Refractory)
Results of Analyses

Unit : mass%

Constituent	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	Cr ₂ O ₃	ZrO ₂ (+HfO ₂)	HfO ₂	ZrO ₂ *3
Certified value	45.7 ₀	0.45 ₁	0.30 ₈	0.09 ₉	3.07 ₈	0.54 ₈	0.04 ₃	0.01 ₀	0.11 ₃	0.00 ₉	49.7 ₂	0.98 ₇	48.7 ₄
Laboratories													
L ₁	45.6 ₉ G	0.47 ₅ i	0.31 ₃ i	0.09 ₈ i	3.12 ₃ i	0.55 ₂ i	0.04 ₀ a	0.00 ₉ a	0.10 ₅ c	0.01 ₀ i	49.6 ₄ g	0.98 ₂ x	—
L ₂	45.6 ₇ G	0.44 ₆ i	0.30 ₆ c	0.09 ₆ i	3.11 ₂ i	0.53 ₈ i	0.04 ₄ a	0.01 ₆ a	0.11 ₉ c	0.00 ₉ i	49.7 ₀ g	1.01 ₃ i	—
L ₃	45.6 ₅ G	0.44 ₈ i	0.29 ₇ c	0.09 ₈ c	3.05 ₄ i	0.53 ₇ i	0.04 ₆ a	0.01 ₀ a	0.11 ₁ c	0.00 ₉ i	49.5 ₂ g	0.95 ₂ i	—
L ₄	45.7 ₁ G	0.44 ₇ a	0.30 ₀ c	0.10 ₁ c	3.10 ₆ a	0.53 ₉ a	0.04 ₃ a	0.00 ₇ a	0.10 ₈ c	0.00 ₇ a	49.6 ₇ g	0.96 ₁ x	—
L ₅	45.7 ₃ G	0.43 ₂ i	0.31 ₄ i	0.10 ₀ i	3.06 ₀ i	0.56 ₀ i	0.04 ₇ a	0.01 ₂ a	0.11 ₇ c	0.00 ₆ i	49.7 ₁ g	0.98 ₇ i	—
L ₆	45.7 ₀ G	0.46 ₄ a	0.30 ₇ c	0.10 ₀ c	3.09 ₇ a	0.54 ₄ a	0.04 ₂ a	0.01 ₀ a	0.11 ₈ c	0.00 ₈ a	49.7 ₄ g	0.97 ₇ x	—
L ₇	45.6 ₃ G	0.45 ₆ i	0.30 ₇ c	0.09 ₇ c	3.05 ₃ i	0.54 ₅ i	0.04 ₀ a	0.00 ₈ a	0.10 ₆ c	0.01 ₀ i	49.8 ₁ g	1.02 ₇ i	—
L ₈	45.6 ₇ G	0.44 ₂ a	0.31 ₄ c	0.09 ₈ c	3.05 ₈ a	0.55 ₂ a	0.04 ₂ a	0.00 ₈ a	0.11 ₆ c	0.01 ₀ a	49.7 ₄ g	0.99 ₉ i	—
L ₉	45.8 ₃ G	0.44 ₆ a	0.31 ₁ c	0.10 ₀ c	3.03 ₅ a	0.56 ₁ a	0.04 ₂ a	0.00 ₈ a	0.12 ₀ c	0.00 ₈ a	49.9 ₉ g	0.98 ₃ x	—
Average (\bar{X})	45.69 ₈	0.450 ₇	0.307 ₇	0.098 ₇	3.077 ₆	0.547 ₆	0.042 ₉	0.009 ₈	0.113 ₃	0.008 ₆	49.72 ₄	0.986 ₈	48.73 ₇
Standard deviation (Reproducibility) s_x	0.06 ₃	0.012 ₉	0.006 ₁	0.001 ₇	0.032 ₇	0.009 ₂	0.002 ₆	0.002 ₉	0.005 ₉	0.001 ₃	0.13 ₅	0.023 ₈	—
Standard deviation (Reproducibility without laboratories) $s_{I(T)}$ *1	0.06 ₈	0.008 ₂	0.004 ₀	0.001 ₇	0.014 ₃	0.009 ₈	0.002 ₉	0.001 ₄	0.002 ₈	0.001 ₀	0.08 ₇	0.007 ₃	—
Uncertainty C (95%) *2	0.0 ₅	0.01 ₀	0.00 ₅	0.00 ₁	0.02 ₅	0.00 ₇	0.00 ₂	0.00 ₂	0.00 ₅	0.00 ₁	0.1 ₀	0.01 ₈	0.1 ₁ *4

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

* 3 $ZrO_2 = ZrO_2(+HfO_2) - HfO_2$ * 4 $s_{xZrO_2} = \sqrt{(s_{xZrO_2(HfO_2)})^2 + (s_{xHfO_2})^2}$

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