

**The Technical Association of Refractories, Japan**  
**Certified Reference Material for Sulfur Analysis of Refractories**  
**JRRM 1101 – 1106 (Series No.1 for Analyzer for Sulfur Impure Refractories)**  
**Results of Analyses**

Unit: mass%

| JRRM  | 1101         | 1102         | 1103        | 1104        | 1105        | 1106        |
|---|--------------|--------------|-------------|-------------|-------------|-------------|
| Component                                       | Sulfur       |              |             |             |             |             |
| Chemical Symbol                                 | S            |              |             |             |             |             |
| Certified value                                 | <b>0,106</b> | <b>0,293</b> | <b>1,02</b> | <b>1,48</b> | <b>2,89</b> | <b>4,93</b> |
| Laboratory L <sub>1</sub>                       | 0,100 5      | 0,267 0      | 1,010       | 1,442       | 2,857       | 4,882       |
| L <sub>2</sub>                                  | 0,101 5      | 0,280 0      | 1,024       | 1,450       | 2,832       | 4,844       |
| L <sub>3</sub>                                  | 0,107 0      | 0,307 5      | 1,024       | 1,473       | 2,868       | 4,926       |
| L <sub>4</sub>                                  | 0,107 5      | 0,308 0      | 1,038       | 1,515       | 2,882       | 4,924       |
| L <sub>5</sub>                                  | 0,105 5      | 0,288 0      | 1,026       | 1,498       | 2,906       | 4,908       |
| L <sub>6</sub>                                  | 0,112 5      | 0,286 5      | 1,039       | 1,502       | 2,909       | 4,986       |
| L <sub>7</sub>                                  | 0,099 5      | 0,283 5      | 0,987       | 1,461       | 2,888       | 4,974       |
| L <sub>8</sub>                                  | 0,113 5      | 0,321 0      | 1,043       | 1,540       | 2,955       | 5,010       |
| Average $\bar{\bar{X}}$                         | 0,105 94     | 0,292 69     | 1,023 8     | 1,485 1     | 2,887 1     | 4,931 8     |
| Standard deviation                              |              |              |             |             |             |             |
| Reproducibility $s_{\bar{x}}$                   | 0,005 27     | 0,017 81     | 0,018 4     | 0,034 1     | 0,037 4     | 0,055 5     |
| Reproducibility within laboratory $s_{I(t)}$ *1 | 0,003 99     | 0,009 47     | 0,014 3     | 0,022 7     | 0,022 6     | 0,037 8     |
| Uncertainty $C(95\%)$ *2                        | 0,005        | 0,015        | 0,02        | 0,03        | 0,03        | 0,05        |

(Note) \*1  $s_{I(t)}$  is time-differenet intermediate precision standard deviation.

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

(1) List of laboratories: Krosaki Harima Corporation, JFE Refractories Corporation, Taiko Refractories Co., Ltd

Asahi Glass Ceramics Co., Ltd., Shinagawa Refractories Co., Ltd., TYK Corporation

Taiheiyo Consultant Co., Ltd , Chuken Consultant Co., Ltd

(2) Analytical methods ; JIS R 2016-1(Methods for determination of sulfur in refractory products and raw materials

— Part 1: Gravimetric and titrimetric methods)

(3) Each analytical value is the average of two values obtained by two measurements on different days.

(4) Outlier tests were carried out by Grubbs test method. The samples rejected by Grubbs tests were discussed in view of analytical techniques and it was decided whether they should be adopted or not.

(5) Date of preparation : April, 2008

Prepared, Values  
given and Certified by

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