Enhanced Strength CERABEADS® to meet your needs for production

- Made of dense mullite crystal
- Resistant to abrasion crush and thermal shock
- For high heat resistance and low thermal expansion
- Spherical for good compaction, fluidity and enhanced strength
- The same chemical composition as before

Improve your strength
Lower your binder level
CERABEADS®-ES Chemical Composition % (measured by Fluorescent X-Ray Analyser)

<table>
<thead>
<tr>
<th></th>
<th>Al₂O₃</th>
<th>SiO₂</th>
<th>Fe₂O₃</th>
<th>TiO₂</th>
<th>CaO</th>
<th>MgO</th>
<th>K₂O</th>
<th>Na₂O</th>
<th>P₂O₅</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60.83</td>
<td>35.70</td>
<td>1.09</td>
<td>0.86</td>
<td>0.29</td>
<td>0.13</td>
<td>0.19</td>
<td>0.39</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Using carefully selected raw materials, contents are adjusted, so the chemical composition is stable from lot to lot.

Physical Property Comparison chart with other Sands

<table>
<thead>
<tr>
<th></th>
<th>Refractoriness °C</th>
<th>Heat Resist. Passing rate%</th>
<th>Bulk Density g/cm³</th>
<th>Permeability</th>
<th>Thermal Expansion % (at 300 sec)</th>
<th>Fracture rate% (according to JIS G-5-15 standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERABEADS®-ES</td>
<td>1,825</td>
<td>100</td>
<td>1.75</td>
<td>230</td>
<td>-0.06</td>
<td>106</td>
</tr>
<tr>
<td>NAIGAI CERABEADS®</td>
<td>1,825</td>
<td>100</td>
<td>1.70</td>
<td>251</td>
<td>-0.08</td>
<td>106</td>
</tr>
<tr>
<td>SILICA</td>
<td>1,730</td>
<td>100</td>
<td>1.58</td>
<td>259</td>
<td>1.56</td>
<td>126</td>
</tr>
</tbody>
</table>

※1 Sieve passing rate after heating the sand to 1500°C and vibrating for 3min through 3.35mm sieve.
※2 Bulk density measured after vibrating the sand for 3min. ※3 Sand measured after being passed through 50/70 mesh sieve.

CANN WITHSTAND TEMPERATURES UP TO 1,825°C(SK37) PROVING ITS HIGH HEAT RESISTANT PROPERTY

HAS BETTER COMPACTION THAN NAIGAI CERABEADS®, WHILE IMPROVEMENT IN STRENGTH IS SHOWN FOR COLD BOX AND NO BAKE PROCESSES

DENSE MULLITE CRYSTAL

SIEVE ANALYSIS

COLD BOX STRENGTH*

PHENOLIC ESTER NB STRENGTH COMPARISON®

Figure 1. SEM photo

Figure 2. Sieve Analysis

Figure 3. Phenolic Ester NB transverse strength comparison
Test Conditions: Resin 1.5 w%, 25°C-55%RH (using humidity chamber)
※Strength test results will vary depending on test conditions

Figure 4. Cold Box transverse strength comparison
Test conditions: Part I 0.6 w%, Part II 0.6 w% 25°C-55%RH (using humidity chamber)
※Representative values are used for data in this catalog.

April 14th, 2017