SILICON NITRIDE POWDER (SHS-ACID ENRICHMENT)

Description
Silicon nitride obtained by the SHS method is a white powder with the grayish tint. The main features of the powder are given in the table below. \( \beta - \text{Si}_3\text{N}_4 \) are well-formed plate, columnar and filiform crystals; \( \alpha - \text{Si}_3\text{N}_4 \) look like round shape grains with the single columnar crystals.

Microstructure of silicon nitride powders:
\[ a, c \, \rightarrow \, \beta - \text{Si}_3\text{N}_4, \quad b \, \rightarrow \, \alpha + \beta - \text{Si}_3\text{N}_4. \]

The main features of silicon nitride

<table>
<thead>
<tr>
<th>Chemical composition, mass %</th>
<th>nitrogen</th>
<th>≥ 39.0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>oxygen</td>
<td>≤ 1.0</td>
</tr>
<tr>
<td></td>
<td>iron</td>
<td>0.02-0.1</td>
</tr>
<tr>
<td></td>
<td>free silicon</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Phase composition, %</td>
<td>( \alpha + \beta - \text{Si}_3\text{N}_4 )</td>
<td>( \alpha - \text{Si}_3\text{N}_4 ) no less than 75 %</td>
</tr>
<tr>
<td></td>
<td>( \beta - \text{Si}_3\text{N}_4 )</td>
<td>no less than 97 %</td>
</tr>
<tr>
<td>Specific surface, m(^2)/g</td>
<td></td>
<td>2.0 – 10.0</td>
</tr>
</tbody>
</table>

Technical appraisal and economic benefits
The main advantage of a silicon nitride obtained by the SHS method is low cost of the high quality product. The use of chemical interaction energy and application of industrial ferrosilicon as a basic material result in reduction of the price. The purity of powder is achieved by means of acid enrichment.

Application areas
The powder can be used for production of high-strength structural ceramics, cutting plates and wear-resisting parts; it also can be a component of different composite materials as well.

Development stage
Preproduction of nitride silicon powders of different phase composition (\( \alpha + \beta - \text{Si}_3\text{N}_4 \) and \( \beta - \text{Si}_3\text{N}_4 \)) has been started at the Department for Structural Macrokinetics, Tomsk Science Centre of the Siberian Branch of the Russian Academy of Sciences. The volume of production is 200 kg per year and price is several times less than the world market price.
Patent situation

Commercial offers
Joint promotion of the product to the Russian market.
Joint development of the industrial technology of nitride silicon powder producing by SHS-acid enrichment.

Estimated cost
To be negotiated.

Contacts
Professor Yury Mikhailovich Maksimov, Head of the Department
Department for Structural Macrokinetics, Tomsk Scientific Centre of the Siberian Branch of the Russian Academy of Sciences
10/3, Prospect Academic hesky, Tomsk
Tel.: (3822) 492 702
Tel./fax: (3822) 492 838
E-mail: maks@fisman.tomsk.ru