DOI 10.1007/s11148-014-9729-5
*Refractories and Industrial Ceramics* *Vol. 55, No. 4, November, 2014*

# INVENTIONS

## REVIEW OF RF PATENTS FOR REFRACTORY INVENTIONS

### Review prepared by the editorial staff of Novye Ogneupory[1]

Translated from *Novye Ogneupory*, No. 7, pp. 67 – 68, July, 2014.

#### A Method of Producing Nanodisperse Zirconium Oxide Powder Stabilized with Yttrium Oxide and/or Scandium Oxide

*V. D. Zhuravlev and M. Yu. Sennikov*

Patent RU 2492157
IPC C04B35/486, C04B35/626, C04B13/18

The invention pertains to the chemical industry, in particular, to methods of producing finely dispersed powders based on zirconium oxide which may be used for the fabrication of dense wear-resistant ceramic, materials for implantology, and solid electrolytes. The technical result of the invention lies in the creation of nanopowders that are resistant to caking and by means of which high-density ceramic based on the nanopowders may be fabricated.

The present method of producing nanodisperse powders of zirconium oxide stabilized with yttrium oxide and/or scandium oxide comprises the production of an initial mixture of nitrates of the corresponding metals and glycine, heating of the mixture to 160 – 250°C, and holding at this temperature with subsequent annealing. The method is distinguished by the fact that carboxylic acid and/or ammonium salts of carboxylic acid are additionally added at a rate of 5 – 20 wt.% of the glycine content to the initial mixture. Annealing is performed at 550 – 570°C.

*Inventions Bulletin: Utility Models,*[2] *No. 25, 163 (2013)*

#### A Mixture for Bonding Plates

*V. I. Korneev, N. I. Nuzhdina, S. I. Petrov, and G. P. Shlomin*

Patent RU 2493121
IPC C04B28/02, C04B24/24, C04B24/16, C04B111/20

The present mixture for bonding plates, which contains Portland cement, quartz sand, limestone, cellulose ester, vinyl acetate copolymer, and a plasticizer, is distinguished by the fact that melamine sulfonic acid copolymer and formaldehyde serve as the plasticizer and that calcium formate and nepheline slurry are also added, with the following ratio between all the components, wt.%: Portland cement, 30.0 – 34.5; quartz sand, 55.0 – 59.5; limestone, 5 – 7; cellulose ester, 0.20 – 0.25; vinyl acetate copolymer with vinyl versatate, 1.0 – 1.5; melamine sulfonic acid copolymer and formaldehyde, 0.3 – 0.5; calcium formate, 1.0 – 1.2; and nepheline slurry, 3 – 5.

The technical result of the invention is seen in an improvement in the wetting power of the mixture and an increase in the cohesive strength of the mixture with a bonded surface in the first days of hardening.

*Bulletin, No. 26, 245 (2013)*

#### A Dinas Refractory and Method of Fabrication

*K. A. Maksunov, V. K. Bakhtina, E. M. Grishpun, A. M. Gorokhovskii, and L. A. Karpets*

Patent RU 2494075
IPC C04B35/14

The invention pertains to the fabrication of Dinas refractory articles for the lining of heating units. The technical result of the invention is seen in an increase in strength and a decrease in porosity and in the content of residual quartz.

1. The present Dinas refractory obtained from a composition containing a silicic filler, Portland cement, and a conditioner is distinguished by the fact that the silicic filler contains quartz glass in a fraction finer than 5 mm, demagnetized quartzite in a fraction finer than 0.09 mm, and quartz sand, while an aqueous solution of sodium polymethylene naphthalene sulfonate serves as the conditioner, with the following ratio between the components, wt.%: Portland cement, 3 – 6; conditioner (above 100%), 7.5 – 8.5; demagnetized quartzite in a fraction finer than 0.09 mm, 20 – 40; quartz sand, 0.5 – 0.3; and quartz glass, the remainder.

2. The method of fabricating the Dinas refractory described in Part 1 comprises batching of the components and

[1] OOO Intermet Inzhiniring, Moscow, Russia.
[2] Subsequently we use the abbreviated name *Bulletin*.

mixing, molding, drying, and roasting, and is distinguished by the fact that molding is performed by means of vibratory casting while drying of the molded refractory is performed following preliminary holding in the mold for a period not less than 7 h at a temperature of 28 – 35°C and natural drying off for 8 h following disassembly of the mold.

*Bulletin, No. 27, 184 (2013)*

### A Method of Fabricating Ceramic Articles Based on Zirconium Dioxide

*A. V. Lyashenko, V. S. Bakshutov, E. A. Sigitov, R. V. Tikhonov, N. T. Andrianov, and N. A. Popova*

Patent RU 2494077
IPC C04B35/486, B82B3/00

The invention pertains to the fabrication of ceramic articles from material based on partially stabilized zirconium dioxide, such as hyper-sharp and wear-resistant high-strength cutting tools for surgery, traumatology, orthopedics and prosthetics, and wear-free friction pairs for bearings, tumbling balls, pistons of brake disks, draw plates, rollers, nozzles, springs, etc. for service under high-temperature conditions and conditions of corrosive media.

The present method of fabricating ceramic articles based on zirconium dioxide consists in preparation of an initial raw mixture the components of which are taken in the following ratio, wt.%: yttrium oxide and/or cerium oxide, 0.35 – 15.50; modifier additive in the form of an oxide of a transition metal selected from the following group: iron, aluminum, cobalt, nickel, copper, titanium, and manganese, 0.20 – 3.50; zirconium dioxide, remainder (up to 100). Chemical deposition of particles of the mixture measuring up to 100 nm and drying of the mixture to a moisture content of 1 – 2% in batch dryers in 3-l corundum capsules at 100 – 150°C with deagglomeration running of the powder through a sieve or in rotating drying ovens without deagglomeration to achieve a specific surface of the powder of 60 $m^2/g$ is performed. Uniaxial two-sided compaction on hydraulic axial or radial magnetic-pulse presses in single- or multi-cavity metallic press molds hardened to 55 – 60 *HRC* with smoothness of the working surface at the ninth smoothness grade is then performed under a pressure of 200 – 500 MPa on hydraulic presses and then to 1200 MPa on magnetic-pulse presses with control of the mean density and geometry of a billet of the article. The compacted billet, supported on corundum foundations, is then placed in batch dryers in which the billets are dried for 7 – 8 h at 200 – 250°C. The billets are then processed with a diamond tool according to rough drawings to impart a required form, roasting is performed at 1450 – 1500°C in high-temperature batch ovens with chromite lanthanum or disilicide molybdenum heaters, followed by quenching for 1.5 – 2.5 days, final processing, and finishing and polishing of the working surfaces with the use of a diamond tool on a metallic binder and finely dispersed grinding powders.

*Bulletin, No. 27, 184, 185 (2013)*

### A Method of Producing Corundum Ceramic

*É. M. Nikiforova and R. G. Eromasov*

Patent RU 2494994
IPC C04B35/111

The invention pertains to methods of producing corundum ceramic material intended for the fabrication of articles from construction ceramic with elevated static loads. The technical result of the invention is seen in the production of corundum ceramic possessing low roasting temperature with high bending strength indicators.

The present method of producing corundum ceramic, which comprises grinding and mixing of alumina with preliminarily caked glass-additive mineralizer and fluorine-containing additive, and compaction and roasting of the ceramic, is distinguished by the fact that the three-component glass-forming system $P_2O_5$–$B_2O_3$–$SiO_2$ with ratio between the components (1 – 2):(0.5 – 1.0):(2.5 – 3), which is been preliminarily caked at 400 – 450°C, is used as the glass-additive mineralizer. The system is mixed either with fluorides or with chlorides of alkaline metals and alumina with the following ratio between the components of the raw mixture, wt.%: alumina, 81 – 83; glass-additive mineralizer, 15 – 16; and fluorides or chlorides of alkaline metals, 2 – 3. The ceramic is roasted at 1310 – 1340°C.

*Bulletin, No. 28, 188 (2013)*