ABSTRACTS

UDC 666.762.3:662.8.056.2:[66.041.043.1

The increasing of the lining resistance of non-ferrous metallurgy units by the refractory in pregnation with the binder

Slovikovskiy V. V., Gulyaeva A. V. // New Refractories. — 2022. — No 1. — P. 3–6.

There are given the results of the laboratory researches of the increasing of the lining resistance of convertors, welz-kilns, electric ore smelting furnaces by the impregnation of the lining of the refractories with the binder components. There are described the conditions of the exploitation of the experimental lining and the nature of its destruction. The integration of suggesting measures can help to increase by 1,4–1,6 times the resistance of the non-ferrous metallurgy units. Ill. 2. Ref. 16. Tab. 2.

Key words: lining of thermal units, refractory impregnation, ASP binder, high-duty refractory glue, slag-matte melt, pitch coke.

UDC 669.054.82:666.974.2

The use of raw materials from smelted alumina products for the manufacture of refractory concretes

Davydov S. Ya., Apakashev R. A., Kazak O. O., Fedorov S. A., Perepelitsyn V. A., Arzamastsev V. N., Krutikov A. V., Simisinov D. I. // New Refractories. — 2022. — No 1. — P. 7–12.

The list of applications and properties of smelted high-alumina materials, calcium- and magnesium-aluminate compositions, obtained by NPO «VostIO-Ural» from Klyuchevsky Ferroalloy Plant is presented. The chemical composition, physical and mechanical properties of the smelted alumina product are given (PPG). Investigations on abrasion and dynamic strength of PPG-30 and PPG-50 specimens are presented. Photographs of chips of massive samples of PPG-30 and PPG-50 binding materials, as well as PPG-30B concrete from the industrial site of NPO «VostIO-Ural» were obtained. Diffraction patterns of samples PPG-30, PPG-50 and concrete PPG-30B are presented. For short-term storage of raw materials of refractory materials, a waterproof screen in the form of a geomembrane is proposed as a substrate. Ill. 12. Ref. 10. Tab. 2.

Key words: technogenic raw materials, smelted alumina products (SAP), refractory concrete, geomembrane.

UDC 666.762.11.046.512:666.1.031.5

Fused high-alumina refractories and prospects for their production

Sokolov V. A., Gasparyan M. D., Kirov S. S. // New Refractories. — 2022. — No 1. — P. 13–17.

Information is given on various types of fused-cast high-alumina refractories-corundum, (α+β)-alumina and corundospinelid. Is shown that (α+β)-alumina refractory MK-1 in terms of corrosion resistance and tendency to release defects (gas bubble) is on a par with the Jargal M refractory in melts of electrovacuum glass C52-1 and optical glass CO33-M. Corundospinelid refractories MK-4 and MK-13 are characterized by high quality indicators and can be recommended for the production of electrovacuum, optical and other glasses. The necessity of creating an industrial production of fused-cast high-alumina refractories based on domestic developments, taking into account the best foreign achievements, is noted. Ill. 4. Ref. 7. Tab. 4.

Key words: fused high-alumina refractories, electric arc furnace, (α+β)-alumina refractory, corundospinelid refractory, corrosion resistance, glass furnace, electrovacuum glass C52-1, optical glass CO-33M.

UDC 661.666.23:539.232]:669.713.7

Thermal expanded graphite materials in metallurgy

Malakho A. P., Yurkov A. L., Pylaev A. E., Avdeev V. V. // New Refractories. — 2022. — No 1. — P. 18–21.

The peculiarities of implementation of thermal expanded graphite materials (TEG), as barrier materials in reduction cells, are examined in the paper. The experience of industrial application of the graphite foil barrier layer for the protection of the refractory part of the reduction cells, the advantages and disadvantages of the graphite foil barrier materials are analyzed. The decision on the increase of the properties of the barrier materials with the help of antioxidation impregnation is suggested. Ill. 4. Ref. 9.

Key words: thermal expanded graphite (TEG), graphite foil (GF), reduction of aluminium, cryolite, barrier layer.

UDC 666.974.2:669.713.7

Heat-resistant concrete based on technogenic raw materials for mounting the edges of aluminum cells

Glagkikh I. V. // New Refractories. — 2022. — No 1. — P. 22–25.

The results of the development of heat-resistant concrete compositions based on technogenic raw materials are presented for mounting the edges of aluminum cells. It has been established that the use of refractory filler based on «ideal» sieving curve allows to obtain concrete with high quality parameters. Ill. 1. Ref. 9. Tab. 4.

Key words: heat-resistant concrete, aggregate, technogenic raw materials, particle size distribution, aluminium electrolytic cell.

UDC 666.972.11:[666.1.031.2/.6:629.488.36.002.68(62)

Utilization of demolished waste of glass kilns for the synthesis of high-strength, low-cement alumina-zirconia-silica refractory matrix

Bayoumi Ibrahim M. I., El-Amir Ahmed A. M., El-korashy Sabry A., Shalaby Nasser H., Ewais Emad M. M. // New Refractories. — 2022. — No 1. — P. 26–35.

Herein low-cement alumina-zirconia-silica matrices with outstanding high-temperature strength have been successfully produced for the first time from the demolished industrial trashes obtained from glass melting furnaces. Different fine matrix mixes with Al_2O_3/SiO_2 ratios of 1 to 3 were formed from the fine powders with particle sizes of less than 500 μm of ZAC, calcined alumina, refractory cement, and silica fume. The formed batches were cast with water, demolded, dried, and fired at different sintering

temperatures. The experimented mixture of the formula Al_2O_3/SiO_2 = 3 presented the maximum load capacity (132 MPa), the highest density (2,76 g/cm^3), and the lowest porosity (1,42 vol. %) at 1375 °C. The formulated refractory mixture from demolished wastes of glass melting furnaces with Al_2O_3/SiO_2 = 3 can be substantially proposed as a potential matrix for synthesizing low cement refractory castable with application temperature up to 1375 °C for the sake of lining specific parts of cement kilns. Ill. 6. Ref. 41. Tab. 2.

Key words: low-cement refractory castables, industrial wastes, alumina-zirconia-silica (AZS) matrix.

UDC 666.3:549.6.04].017:543.575

Investigation of sintering processes of zirconates by dilatometry method

Komolikov Yu. I., Khrustov V. R., Kashcheev I. D., Pudov V. I. // New Refractories. — 2022. — No 1. — P. 35–38.

The results of dilatometric studies of the process of high-temperature treatment (sintering) of zirconates ($CaZrO_3$, $SrZrO_3$, $BaZrO_3$) and ceramics based on ZrO_2 stabilized by Y_2O_3 (YSZ) are presented. Dilatometric data, for each composition, are expressed as a dependence of the coefficients of thermal linear expansion (TKLR). It is established that the high-temperature treatment of zirconates has several stages, which differ for each composition and are associated with structural-phase transformations occurring in the samples. It is shown that holding a six-hour isothermal exposure at a firing temperature of 1550 °C is sufficient to undergo the sintering process of YSZ and $SrZrO_3$, but does not provide complete sintering of $CaZrO_3$ and $BaZrO_3$ samples. Ill. 5. Ref. 7. Tab. 4.

Key words: zirconates, zirconium dioxide, ceramics, TKLR, ultrafine powders, dilatometry method.

UDC 541.8:[666.192.2:53.072.4

Surface properties of suspensions based on fused silica

Zhuravlev Ya. A., Ovchinnikova A. O., Ysol'tsev E. A., Furman E. L., Furman I. E. // New Refractories. — 2022. — No 1. — P. 39–42.

In this work, the surface properties of the suspension for the manufacture of molds used in the lost wax casting were investigated. The results of determining the contact angles of wetting with a suspension of different model compounds and the surface tension of the suspension using various binders are presented. During the work conclusions were drawn about the choice of the suspension formulation for the manufacture of a ceramic shell. Ill. 4. Ref. 9. Tab. 1.

Key words: lost wax casting (LWC), fused silica, model compound (MC), ceramic shell (CS), binder, fireproof filler, surface tension, contact angle.

UDC 666.3-127:[539.297.1+544.023.522

Clarification of methods for determining the properties of powder ceramics

Kryuchkov Yu. N. // New Refractories. — 2022. — No 1. — P. 43–47.

The methodological requirements for the conducted research are clarified by mandatory specifying the sizes of samples for experiments. The necessity of using mass values of structural parameters of materials rather than volume values, as well as taking into account the gradient properties of porous materials, is noted. The inconsistency of the results from different methods for determining the parameters of the porous structure and properties of ceramics is noted due to the inaccuracy of the models of the porous medium and percolation effects. A new (more rigorous) method for determining the filtering properties of porous ceramics based on experimental data is proposed. Ill. 5. Ref. 14. Tab. 1.

Key words: permeable ceramics, porous structure, bulk porosity, particle size, radii of capillaries, permeability, percolation effects, gradient properties.

UDC 666.3:546.831-31+669.14-62-436.1].017:539.92

Technological support of tribological characteristics of the hybrid friction pair Y–TZP-ceramics – hardened steel

Kuzin V. V., Grigor'ev S. N., Fedorov S. Yu. // New Refractories. — 2022. — No 1. — P. 48–54.

The relationship between the parameters of grinding regime with nature of friction interaction and tribological characteristics of hybrid friction pair of steel ball-sample Y–TZP ceramics at the run-in stage is established. It is shown that the mechanism of influence of ceramic part manufacturing technology on friction interaction conditions, friction coefficient, width and condition of friction track is based on changes in roughness and morphology of grinded ceramic surface after finishing machining. Technological recommendations for the manufacture of ceramic parts for hybrid friction pair is developed with using the revealed patterns. Ill. 4. Tab. 25.

Key words: Y–TZP ceramics, grinding regime, roughness, morphology of surface, friction, tribological characteristics, material transfer, wear.

UDC 504.7

«Carbon footprint» in metallurgy and refractory industry

Kononov V. A. // New Refractories. — 2022. — No 1. — P. 55–65.

The problem of greenhouse gas emissions («carbon footprint») in different industries and the efforts of different countries, including Russia, aimed at reducing CO_2 emissions are considered. The sources of carbon footprint formation and technologies allowing to reduce CO_2 emissions in blast furnace and steel production in Russia, as well as CO_2 capture technologies used in some other industries are presented. Recommendations for reducing the carbon footprint in refractory production are given. Ill. 4. Ref. 7.

Key words: carbon footprint, carbon tax, green energy sources, CO_2 emission reduction, CO_2 capture technologies.