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Abrasive superhard composite materials based on diamond and cubic boron nitride structured by nanocarbon binder at subatmospheric pressures intended for grinding and polishing tools and pastes

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The results of work on the development of abrasive superhard composite materials based on diamond and cubic boron nitride due to structuring the powder material by carbon binder at subatmospheric pressures are presented in the paper. The use of new material results in increase of efficiency of grinding and polishing tools and pastes based on superhard materials. It was first found that during the formation of the carbon binder from carbon-containing gas (CH_4) on the surface of particles in the diamond and cubic boron nitride compacts the filamentous carbon particles (whiskers), which bind the particles together, are formed under such conditions: temperature gas flow rate – 3.1 10-5 - 4.7 10-5 m3/s. It was ascertained that the formation in the structure of the compacts, specifically in space between the grains of initial SHM, globular and filamentous carbon results in increased thermal stability of the compacts, the strength of the compacts is not decreased at heating to 1474 K in argon. It was found that just addition to initial powders the micron powders of diamond or cBN of grain sizes: 3/2, 2/1, 1/0 results in increase of strength of composite by 20 % due to decrease of pore size of the composite. Experimental-industrial test showed advantages of the composite materials, a increase of durability of the grinding tool by 1.5 -3.0 times and a increase of abrasive abilityof pastes by 1.3 - 1.5 times.

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The effect of carbon materials on the performance of a direct carbon fuel cell with molten hydroxide electrolyte

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The direct carbon fuel cells (DCFCs) belong to new generation of energy conversion devices that are characterized by much higher efficiencies and lower emission of pollutants than conventional coal-fired power plants.[1]Over the past several decades fuel cell technologies have been treated as promising candidates for various utility applications.Today fuel cells are still considered an environmentally friendly and highly efficient electricity generating systems and extensive research has been conducted worldwide to improve this technology.The direct carbon fuel cell (DCFC) is a unique type of fuel cell able to convert efficiently the chemical energy of solid carbonaceous fuels directly into electricity without the combustion of the fuels. The theoretical maximum efficiency of carbon conversion in the DCFC is 100%,but practical efficiencies have been demonstrated at roughly 80% [2]. The direct carbon fuel cell (DCFC) can be used to generate electricity directly from almost any carbonaceous fuel, including carbonaceous waste materials, graphite, charcoals,carbon blacks, carbon fiber, and coals.[3]Here we focused different carbon materials such as commercial graphite,carbon black,commercial hard coal,biochar and active carbon,thus can find a better material for the improvement of the molten hydroxide direct carbon fuel cell. Biomass carbon sources with an inter-connected multirole pore or beneficial element through a green route are a new generation of electrode, which is rapidly expanding research area. The extraordinary synthetic approach presented here opens the door of green chemistry for biomass-based the direct carbon fuel cell, which considers various pore geometries and dipping of element to design electrode materials with improved battery performance. Above all, the routes used to synthesize this carbon-based electrode are readily scalable to industrial levels.

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