Catalytic activity of nanodiamonds in redox process

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Detonation ultradisperse diamonds (UDD) are already offered on the market, but its properties and chemical composition vary with production conditions and degree of purification. The presence of catalytically active metals in UDD suggests that they could be regarded as ready-made nanostructured metallic catalysts on carbon carriers. Its catalytic activity in reaction of ozone decomposition was studied on UDD offered by various manufacturers: UDD-1 - Gansu Goldstone Nano-Material Co., Ltd., China; UDD-2 NanoCarbon Research Institute Ltd., Japan; UDD-3 Real-Dzerzhinsk, Russia; UDD-4 Tekhnolog FSUP SKTB, Russia. All of them, except UDD-1, are similar in elemental composition (carbon content 78.4 to 87.5%), and their H/C values 0.022-0.027, typical of a diamond phase (sp^3). Similar adsorptive characteristics are shown by UDD-2 and UDD-3. The average pore volume is 0.5-0.6 cm^3/g. The average pore radius is 3.4-3.8 nm. UDD-4 has a wider pore size distribution spectrum, and its volume and average radius are 2.5 times as large. The micropore radii, 3.4±0.1 nm, calculated from the Dubinin-Radushkevich equation, are characteristically identical [1].

The specific surface and volume of pores are observed to change slightly during ozonation, whereas the average radius of micropores remains constant and does not depend on the method of synthesis and the UDD purification details.

A high catalytic activity and stability of UDD in a low temperature ozone decomposition reaction could be extended to other redox processes. The catalytic activity depends on metal impurities content and particle size: it decreases by two orders of magnitude if the average particle size is > 200 nm.

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