Laser assisted synthesis of boron nanoparticles

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Recently, there has been great interest in the production of boron nanoparticles, caused by the possibility of their use in composite fuel and in boron neutron capture therapy (BNCT)[1-3]. In this work, Boron nanoparticles are synthesized using laser ablation in isopropanol and subsequent laser fragmentation of the suspension. For this purpose, an ytterbium doped fiber laser was used at wavelength of 1060–1070 nm, pulse repetition rate of 20 kHz, and pulse duration of 200 ns. Laser radiation was focused using an F-Theta lens (F = 204 mm) onto the surface of a sintered boron target located in flow cell. Laser ablation and further laser fragmentation led to the formation of nanoparticles with a size distribution in the range of 7–60 nm (Fig. 1a). Transmission electron microscopy studies confirm the data obtained using a disk centrifuge. Figure 1b shows the morphology of boron nanoparticles. Analysis of the elemental composition of the particle shows that boron NPs have carbon shell. The period of the crystallographic planes of the shell is 0.34 nm, which corresponds to graphitized carbon. Allotropic composition of boron nanoparticles differs from that of the initial Boron target.
Thus, boron nanoparticles obtained by laser ablation and fragmentation in isopropanol are promising candidates both for addition to composite fuel and for use in BNCT.

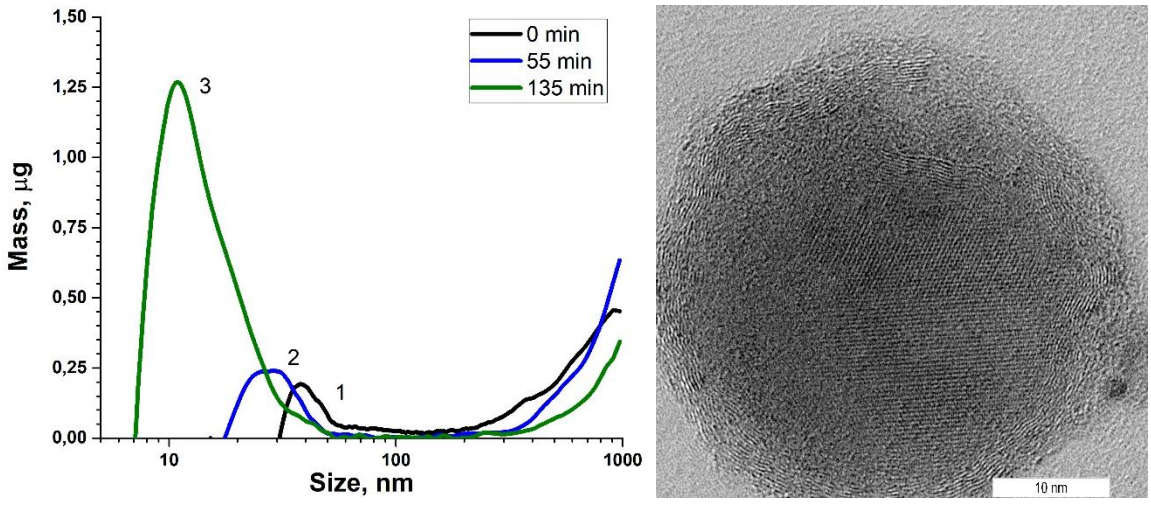

Figure 1: Mass distributions on size of B nanoparticles for different fragmentation times: 0 (1), 55 (2), and 135 min (3) (a). View of individual Boron nanoparticle in transmission electron microscope(b).

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