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Physico-mechanical properties of nanostructured composite biomaterials based on biogenic hydroxyapatite

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The investigations were carried out to determine differences in physic-mechanical properties of nanostructured composite biomaterials based on biogenic hydroxyapatite (BHA) doped with nanomagnetite ($FeO \cdot Fe_2O_3$) which was synthesized by two different methods. In the one case, previously prepared iron oxalate was precipitated on the surface of BHA microgranules in the form of hydrosuspension (physic-mechanical method). In the other case, BHA was introduced directly during the production of iron oxalate (chemical method). After filtration, dehydration and drying, the specific surface area was 7.38 m^2/g for the material obtained by physic-mechanical method and 8.82 m^2/g – for the other one.

The obtained composite material was subjected to low temperature thermolysis in a vacuum at 500 °C for 2 h, herein part of it as a powder and the rest as cylindrical samples with a diameter of 10 ± 0.2 mm and a mass of 1.9 ± 0.3 g. Compaction pressure was 10 MPa.

After thermolysis the weight loss of compact samples was 2.66% for the material obtained by direct introduction of BHA while obtaining iron oxalate and 5.5% for the material obtained through the precipitation of previously prepared iron oxalate on the BHA surface. The values of total / open porosity for the sample from the material obtained by the chemical method were 46.9% / 35.6%, whereas for the sample from the material obtained by the physic-mechanical method – 41.9% / 39.6%. This difference may be responsible for the difference in the elasticity: 7.8 GPa for the material obtained by precipitation of previously prepared iron oxalate on the BHA surface and 4.3 GPa for the material obtained through direct introduction of BHA while obtaining iron oxalate.