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Physicochemical properties of structured bioceramic materials doped with nanomagnetite

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The influence of different technological methods for preparation of nanostructured biogenic hydroxyapatite (BHA) doped synthetic nanomagnetites (Fe_3O_4) on physicochemical properties of bioceramic has been studied. In the first case, nanostructured biogenic hydroxyapatite (BHA) has been doped by mechanical mixing with ferromagnetic additives, and in the second – biomaterial obtained as a result of chemical precipitation of iron oxalates from solution on the surface of BHA with subsequent heat treatment. According to the results of chemical analysis indicated samples contained 1.67 mas.% and 0.98–1.12 mas.% of total iron respectively, whereas iron content for undoped BHA doesn't exceed 0.1–0.15 mas.%. The specific surface area of biomaterial produced by chemical precipitate of iron oxalates (7.46 m^2/g) was higher than that prepared by mechanical alloyed (5.45 m^2/g).

The samples of cylindrical shape (d = 10 mm) with a ratio h/d in the range of 1.2/1 from all of these powders have been obtained by half-dry pressing. For this technology powder humidity was 10–12% and it permits to improve the conditions binding together elements in the disperse systems as well as provides for formation of new structure under transformation freely-dispersed into structured state. After drying, prepared samples have been heat-treated in nitrogen-containing environment at a temperature of 500 °C which is less than the Curie point for the nanomagnetite (572 °C) that guarantees preservation of the magnetic properties. Weight loss of sintered samples was 0.50% for mixing composition as first case and 2.43% for second case as result of thermolysis of iron oxalates. Apparent density of the mechanically alloyed sample and the sample obtained by chemical precipitation is 1.87 g/cm^3 and 1.75 g/cm^3 respectively. At that about 98% of total porosity BHA+1.67% Fe_{total} (40.8%) and BHA+0.98%Fe_{total} (46.4%) are open.