

Preparation and investigation of magnetic nanoparticles for biomedical applications

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Materials based on magnetic nanometals can be applied for production of magnetic carriers for drug delivery, biosensors, magnetic hyperthermia agents, magnetic contrast agents for resonance imaging, magnets, ferrofluids, fillers for polymers, in electronics and xerography. In order to protect the metal nanoclusters against rapid environmental degradation, the carbon shell may be used. Iron and cobalt nanoparticles encapsulated in a carbon matrix were prepared by catalytic decomposition of hydrocarbons on nanocrystalline metals. This method of preparation is simple, inexpensive, easy to control and to scale up-grading. Nanocrystalline iron was obtained by fusion of magnetite followed by reduction. Nanocrystalline cobalt was obtained by precipitation from a cobalt salt solution, calcination and reduction. In both cases a small amount of structural promoters (CaO and Al₂O₃) was added. The obtained nanometals were carburised under methane or ethylene flow. The process of metal oxides reduction and carburisation was carried out in a differential reactor with thermogravimetric mass measurement. After carburisation the samples were cooled under helium or were reduced under hydrogen. The obtained materials were characterised using XRD, TOC, Moessbauer spectroscopy, SEM, TEM and HRTEM methods. Carbon-coated metal nanocapsules and carbon nanotubes were found in the obtained samples.

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