USING ELEKTROCHEMICAL OXIDATION STUDY FOR SYNTHESIS OF MAGNETITE NANOPARTICLES

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Preparation of magnetic nanomaterials and studying their properties – one of the areas of modern science, which are being developed. Monodispersed magnetite nanoparticles are promising for use in the biomedical industry for targeted drug delivery, cell and biochemical products separation, magnetic resonance tomography, immunological studies and other. For the biological and biomedical purposes required high purity magnetite nanoparticles.

We have proposed an electrochemical oxidation method $Fe^{2+} \rightarrow Fe^{3+}$ using Pb-dioxyde anode in an acidic solution of iron (II) sulfate:

$$Fe^{2+} - \bar{e} = Fe^{3+}$$

$$E_0 = 0.771 + 0.059\lg\frac{\alpha_{Fe^{3+}}}{\alpha_{Fe^{2+}}}$$

It was established that the rate of oxidation of Fe^{2+} increases after reaching capacity 1.3V.

Acceleration of oxidation of Fe^{2+} at potentials higher 1.3V associated with the passage adjacent to the water reduction reaction of atomic oxygen:

$$2H_2O - 4\bar{e} = O_2 + 4H^+$$

$$E_0 = 1.228 - 0.0591pH + 0.0147\lg P_{O_2}$$

At potentials higher 1.7V achieved conditions of the process:

$$3H_2O - 6\bar{e} = O_3 + 6H^+$$

$$E_0 = 1.501 - 0.0591pH + 0.0098\lg P_{O_2}$$

which is more energy intensive and therefore undesirable.

To intensify the process to apply mixing, which reduces the thickness of the near-electrode diffusion layer and makes it possible to oxidation current density of 0.7 – 1.2 A/dm^2. In this mode, the process of oxidation of Fe^{2+} is well-controlled and happens fast enough.

As a cathode titanium rod is used, which is characterized by a low overvoltage of hydrogen.

Is a result of the electrolysis solution, was containing Fe^{3+} and Fe^{2+} in a molar ratio of 2:1. After the addition of alkali, precipitate Fe_3O_4 was formed, with particle size 10 – 15 nm and the magnetic susceptibility 1.18.

On the basis of the experimental samples of synthesized magnetite, magnetic fluid was obtained. As medium used stone oil, surfactant – oleinic acid. Saturation magnetization of magnetic fluid – 35 kA/m.

Magnetite obtained by the proposed method has high purity and improved magnetic characteristics that can be used to create new magnetically medicine forms.