Nanocomposites and nanomaterials

Features of the synthesis of Fe_3O_4 nanoparticles for medical application

O.V. Yelenich[1], Y.Y. Shlapa[1], S.O. Solopan[1], V.P. Zalutskyi[2]

[1] *V.I. Vernadskii Institute of General and Inorganic Chemistry of the NAS of Ukraine, 32/34 Prospect Palladina, Kiev 03142, Ukraine.*
E-mail: yelenichsassa@gmail.com

[2] *G.V. Kurdyumov Institute of Metal Physics of the NAS of Ukraine, 36 Academician Vernadsky blvd., Kiev 03680, Ukraine.*

Recently, ferromagnetic materials based on iron oxide nanoparticles are of particular scientific and practical interest. This is due to the fact that these materials demonstrate unique magnetic properties, are non-toxic for living organisms, and may find practical application in medicine for diagnostic (magnetic resonance imaging) and for the cancer treatment (drug delivery, hyperthermia). Since iron oxide nanoparticles can be used as the mediators of hyperthermia treatment, it is important to synthesize weakly agglomerated nanoparticles [1] and develop stable magnetic fluids (MF) with high specific loss power (SLP) values under the action of an alternating magnetic field (AMF). Therefore, particular attention is paid on the development of synthesis methods of weakly agglomerated ferromagnetic nanoparticles based on Fe_3O_4 and investigation of their properties.

This work is devoted to the investigations of the effect of different synthesis methods of Fe_3O_4 nanoparticles, in particular precipitation from aqueous solutions using various organic substances, on their properties. The obtained nanomaterials were characterized by XRD analysis, IR spectroscopy, TEM and magnetic measurements. The investigations showed that iron oxide particles synthesized by different methods were single-phased, crystallized in spinel structure, weakly agglomerated with a narrow particle size distribution and demonstrated magnetic properties, which are typical of superparamagnetic materials. Based on these nanoparticles and aqueous dextran solutions MFs were prepared. The studies of the influence of AMF on these fluids were carried out and the experimental SLP values were measured. It was shown that MFs developed in this work were stable in time, effectively heated under the action of an alternating magnetic field and can be used as the inducers of hyperthermia cancer treatment.

1. *Yelenich O.V., Solopan S.O., Kolodiazhnyi T.V. et al.* Synthesis of iron oxide nanoparticles by different methods and study of their properties // Solid State Phenomena.-2015.-**230**.-P. 108-1138.