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Hollow spheres of $BiFeO_3$: synthesis and properties

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Hollow $BiFeO_3$ spheres of different diameter and density have been synthesized for the first time by ultrasonic spray pyrolysis. All samples exhibited ferromagnetic properties and have record values of residual magnetization and coercive force. A correlation between the particle parameters (diameter, volumetric mass density) and magnetic properties has been established.

keywords: bismuth ferrite, multiferroics, magnetic properties, hollow spheres.

1. Introduction

$BiFeO_3$ (BFO) has a large variety of properties due to different types of magnetoelectric interactions realized in it, which determines numerous practical applications of this compound – from spintronics to medicine [1]. However, bulk BFO is not suitable for practical application because of the presence of a spin cycloid with 62 nm spacing in the magnetic structure [2]. Considerable magnetization values are obtained in nanostructured BFO samples: epitaxial films, nanocrystals below 60 nm in size, nanotubes and nanowires [3]. In spite of the progress made in this field [4,5], many questions concerning the formation of properties of nanostructured BFO samples remain unsolved: the effect of nanoparticle morphology, size, surface and interfaces on the magnetic properties. The development of methods for the production of single-phase samples of different morphology continues to be an urgent problem [3]. There is no available information about synthesis of BFO by ultrasonic spray-pyrolysis (USP) in the literature.

The aim of this work is synthesis of BFO by USP in combination with preliminary drying of spray. This method of synthesis makes it possible to control the conditions for the formation of a solid particle from a drop of liquid solution