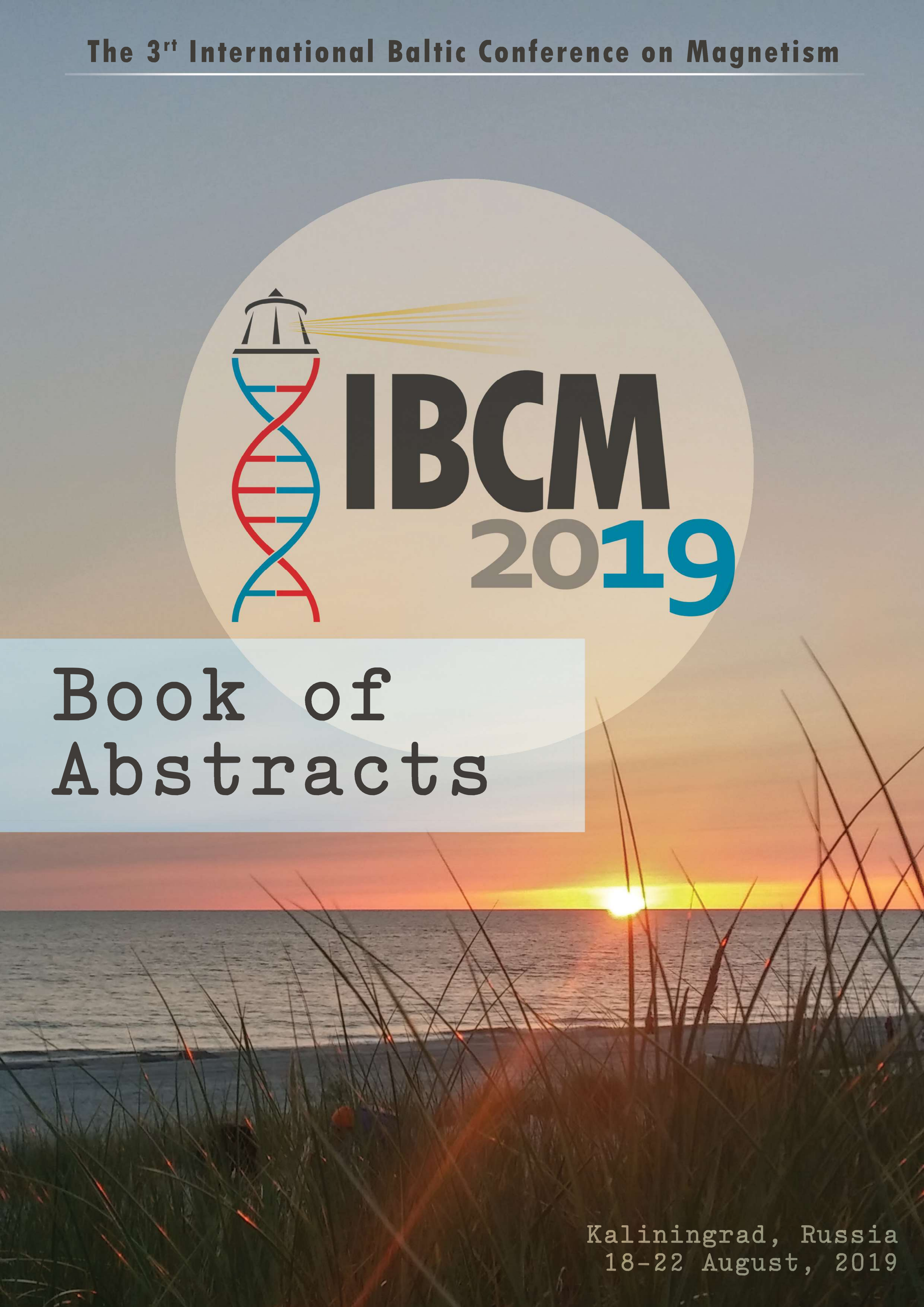
The 3rt International Baltic Conference on Magnetism



IBCM 2019

Book of Abstracts

Kaliningrad, Russia
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International Baltic Conference on Magnetism: nanobiomedicine and smart materials

Kaliningrad, Russia; August 18-22, 2019

IBCM 2019 is organized by Laboratory of Novel Magnetic Materials,

Institute of Physics, Mathematics and Information Technology,

Immanuel Kant Baltic Federal University

Main Topics:

- Magnetic materials for biomedicalapplications
- Manipulation of nanoparticles.Tweezers
- Hyperthermia
- Drug delivery
- Magnetic resonance imaging
- Magnetic particle imaging
- Microfluidics + nanoparticles
- Lab-on-a-chip
- Bio-sensors
- Modeling and simulation mehods
- Design of novel permanent magnets
- Magnetocaloric and multicaloric materials
- Phase transitions and magneticmaterials
- Multiphase and compositematerials
- Magnetostrictive and magnetoelasticmaterials

High temperature treatment of nanochains composed of Fe1–xCox nanoparticles

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Recently, more and more attention is directed towards one-dimensional (1D) magnetic nanostructures such as nanowires, nanorods, nanochains, etc. because these nanomaterials provide unique electrical, optical, magnetic, surface, and chemical properties [1]. Moreover, these properties can be controlled by changing aspect ratios or chemical compositions of materials [2].

Among the simple magnetic materials, the iron-cobalt alloy possesses the highest saturation magnetization and Curie temperature [3]. This causes that this material is interesting for many applications. One of the approaches which allow producing the 1D Fe-Co nanomaterials is a magnetic-filed-induced (MFI) synthesis [4]. In fact, this process leads to the formation of iron-cobalt nanoalloy which reveals a specific structure. Namely, the obtained Fe-Co wires have a form of long straight chains composed of nanoparticles linked each other. Nevertheless, such a structure is very stable due to dipole-dipole interactions between particles forming it.

It is well known that the iron, cobalt as well as iron-cobalt materials are very sensitive to oxygen and tend to oxidize easily [4, 5]. This can be referred as a serious drawback, in particular, in the case of relatively small nanomaterials in which properties depends more on the surface than the bulk. On the other hand, the oxide layer adheres well to the material and prevents against its further oxidation. Secondly, it provides the active sites where the covalent or hydrogen bonds with other compounds can be formed. Lastly, its thickness and chemical composition can be modified with a thermal treatment in presence of different atmospheres. Therefore, this work describes how the nanochains composed of $Fe_{1-x}Co_x$ nanoparticles (where x = 0.75 and 0.25) change their morphologies, chemical compositions and magnetic properties under annealing at 400 °C and 500 °C in two atmospheres containing different content of oxygen. These changes have been traced applying a series of complementary experiments, including scanning electron microscopy (SEM), transmission electron microscopy (TEM), powder X-ray diffraction (XRD), Raman spectroscopy (RS), and vibrating sample magnetometry (VSM).

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