MODERN DEVELOPMENT OF MAGNETIC RESONANCE

abstracts

2021

KAZAN * RUSSIA

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ABSTRACTS OF THE
INTERNATIONAL CONFERENCE

Editors:
ALEXEY A. KALACHEV
KEV M. SALIKHOV

KAZAN, NOVEMBER 1–5, 2021

Magnetic Properties of Double Perovskites $Ba_xSr_{2-x}TiFeO_6$ (x = 0, 0.1, 0.15, 0.25)

D. V. Mamedov[1], R. M. Eremina[1], F. G. Vagizov[2], T. Maiti[3]

[1] Zavoisky Physical-Technical Institute, FRC Kazan Scientific Center of RAS, Kazan 420029, Russian Federation, javi-m@yandex.ru
[2] Institute of Physics, Kazan Federal University, Kazan 420008, Russian Federation
[3] Department of Materials Science and Engineering Indian Institute of Technology Kanpur, Kanpur 208016, UP, India

Currently, thermoelectric materials such as chalcogenides (Bi_2Te_3, Sb_2Te_3, Zn_4Sb_3, Bi_2Se_3, SnTe and others) and intermetallics are mainly used to convert heat into electricity [1]. They have disadvantages, such as toxicity, decomposition, at high temperatures ($T > 600$ K), evaporation, melting and oxidation. As a result, the efficiency of converting heat to electricity at high temperatures is low. However, most of the heat is generated by various sources at temperatures above 900 K. For these temperatures, oxides are a more suitable alternative because of their greater stability at high temperatures, lower cost, and higher oxidation resistance. Among oxide materials, good thermoelectric properties are shown, for example, by Na_xCoO_2, $Ca_3Co_4O_9$ and others [2]. Several oxides of double perovskites have shown promising high temperature thermoelectric properties.

Double perovskite oxides have the formula $A_2B'B''O_6$, where A is alkaline earth metals, lanthanides; B′, B″ are transition metals.

One of the representatives of double perovskites is $Ba_xSr_{2-x}TiFeO_6$. In this work, we investigate the magnetic properties of $Ba_xSr_{2-x}TiFeO_6$ (x = 0, 0.1, 0.15, 0.25). This substance has a cubic structure.

EPR and Mössbauer studies of the samples were carried out. From the EPR and Mössbauer spectroscopy data, we have shown the presence of two magnetic centers of iron (Fe^{3+}, Fe^{4+}) in this substance. The temperature dependences of the magnetization were obtained. It can be seen from the dependence that the magnetic phase transition to ordering state occurs at temperatures of about ~ 17.5 K, 14.5 K, 13.5 K, and 13.0 K for $Ba_xSr_{2-x}TiFeO_6$ (x = 0, 0.1, 0.15, 0.25, respectively.

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