Samarkand State University named after Sharof Rashidov

Samarkand International Symposium on Magnetism

2 – 6 July, 2023

BOOK OF ABSTRACTS

of

Samarkand International Symposium on Magnetism

SISM-2023

Samarkand, Uzbekistan
2023

Samarkand State University named after Sharof Rashidov

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Book of Abstracts

Main Topics

Spintronics, Magnonics, Magnetotransport
Magnetophotonics (linear and nonlinear magnetooptics, magnetophotonic crystals)
High Frequency Properties and Metamaterials
Diluted Magnetic Semiconductors and Oxides
Magnetic Nanostructures and Low Dimensional Magnetism
Magnetic Soft Matter (magnetic polymers, complex magnetic fluids and suspensions)
Soft and Hard Magnetic Materials
Magnetic Shape-Memory Alloys and Magnetocaloric Effect
Multiferroics
Topological Insulators
Magnetism and Superconductivity
Theory
Magnetism in Biology and Medicine
Miscellaneous

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5OT-A-3

MAGNETIC PROPERTIES OF MICRO- AND NANOSIZED POWDERS AND SINGLE CRYSTALS OF $LiREF_4$ (RE = Tb, Dy, Yb)

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Double fluorides $LiREF_4$ (RE = Gd-Yb) have gained attention as model objects in physics of dipolar magnetism. These fluorides share scheelite type, $I4_1/a$ crystal symmetry; unit cell contains two magnetically equivalent rare-earth Re^{3+} ions at sites with the S_4 point symmetry that compose two sublattices. $LiTbF_4$ is dipolar Ising ferromagnet, magnetic moments order along [001] axis, $T_C = 2.89$ K. $LiDyF_4$ and $LiYbF_4$ are dipolar XY-antiferromagnets, magnetic moments order in (001) plane, the $T_N = 0.62$ and 0.13 K, respectively [1, 2].

Microsized powders of $LiREF_4$ (RE = Tb, Dy, Yb) are synthesized by sintering powders of fluorides taken in proportions according to the phase diagrams [3]. Nanosized powders are synthesized using hydrothermal method [4], single crystals were grown by the Bridgman-Stockbarger method. Magnetization of the samples is measured by vibration sample magnetometer VSM at PPMS system at the temperature range 2-300 K and applied magnetic field range 0-9 T, magnetostriction was measured in strong magnetic fields on a capacitive dilatometer [5] in static magnetic fields in the range of 0-8 T at different temperatures. Theoretical analysis is performed within exchange charge model taking into account dipole-dipole and electron-deformation interactions, using Hamiltonian of rare earth ion diagonalized in the full space of the free ion energy states [6].

Qualitative agreement of calculations and experimental data is achieved for all samples of all compounds. Also, our theoretical approach presents quantitative agreement with low-temperature magnetization and magnetostriction measurements of the single crystal $LiYbF_4$ samples and $LiYbF_4$ single crystal inverse susceptibility experimental data from [2]. Magnetization measurements at $B = 10$ mT show transition of $LiTbF_4$ samples in ferromagnetic state; Curie temperature of nanosized powder decreases at 0.1 K in comparison with single crystal and microsized powder sample. $LiDyF_4$ microsized powder sample reveals anomalous magnetic properties: magnetic hysteresis in paramagnetic state (butterfly hysteresis) and slow magnetic relaxation, at $T < 7$ K. $LiDyF_4$ single crystal magnetization measurements prove existence of these phenomena, while diluted single crystal $LiYF_4$:Dy 1% experiments do not display any magnetic hysteresis and slow magnetic relaxation in the temperature range of 2-10 K [6].

Support by Russian Science Foundation (project No22-22-00257) is acknowledged. The authors are grateful to Prof. B. Z. Malkin for helpful discussions and to Prof. R. V. Yusupov for kind permission to use laboratory computer for calculations.

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