be specific, the influence of the cations was investigated by partially substituting Mn by Fe or Co in RMn_2O_5 and Ni in $BiMnO_3$, respectively. The role of the electronic subsystem was investigated by partial substitution of Bi by Sm in $BiFeO_3$. Our magnetization and specific heat measurements of the doped materials provide the phase diagrams which are discussed with respect to the multiferroic properties.

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Resonant soft x-ray scattering from $DyMnO_3$ — •Enrico Schierle, Victor Soltwisch, Detlef Schmitz, Ralf Feyerherm, Dimitri Argyriou, and Eugen Weschke — Hahn-Meitner-Institut, Berlin, Germany

The multiferroic compound $DyMnO_3$ was studied by resonant x-ray scattering at the Dy-M_5 and Mn-L_2 resonances in the temperature range between 5 K and 50 K. The element-selective resonant method permits to study ordering of the Dy-4f and Mn-3d moments seperately, revealing noticeable differences in the character of the ordered moments in the sinusoidal and the helical ferroelectric phase. From the energy dependence of the scattering cross section across the resonances details about ordering of magnetic moments and orbital wave functions can be inferred.

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Multiferroic effect in epitaxial $TbMnO_3$ films — •Joost de Groot[1], Emmanuel Kentzinger[1], Jürgen Schubert[2], Stefan Mattauch[1], and Thomas Brückel[1] — [1]Forschungszentrum Jülich Gmbh D52425 Jülich IFF-4: Streumethoden — [2]Forschungszentrum Jülich Gmbh D52425 Jülich IBN 1-IT

$TbMnO_3$ belongs to a class of rare earth manganites showing multiferroic behaviour. The strong magnetoelectric effect is expected to depend on the dimensionality of the system and on epitaxial strain in thin films. We have grown epitaxial $TbMnO_3$ films of different thicknesses (5-100nm) using Pulsed Laser Deposition on $LaAlO_3$ and $SrTiO_3$ substrates. We analysed the films by x-ray diffraction on a four-circle diffractometer and determined the twinings effects quantitatively. We will report on the thickness dependence of magnetization and electrical polarization as well as on scattering experiments using soft x-ray resonant magnetic scattering and polarized neutron reflectometry.

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Atomic Layer Deposition and Characterization of $BiFeO_3$ Thin Films — •Philipp Leufke[1], Jens Ellrich[1], and Horst Hahn[1,2] — [1]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany — [2]Fachbereich Material- und Geowissenschaften, Petersenstrasse 23, TU Darmstadt, 64287 Darmstadt, Germany

We report on the deposition of multiferroic thin films of bismuth ferrite ($BiFeO_3$) [1] by ALD (atomic layer deposition) using different Fe and Bi precursors at various deposition conditions.

Surface morphology and crystal structure of the prepared thin films are investigated by means of scanning electron microscopy and X-ray diffraction. Energy-dispersive X-ray spectroscopy is employed for chemical analysis.

The magnetic properties are explored via superconductive quantum interference device magnetometry, measurement of the magnetooptical Kerr effect and depth selective conversion electron Mößbauer spectroscopy, with regard to the disagreements raised by former studies on pulsed laser deposited $BiFeO_3$ thin films [2].

[1] W. Eerenstein et al., *Nature* **442**, 759-765 (2006)
[2] (a) J. Wang et al., *Science* **299**, 1719-1722 (2003); (b) W. Eerenstein et al., *Science* **307**, 1203a- (2005); (c) J. Wang et al., *Science* **307**, 1203b- (2005)

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Coupling of structure and magnetism in multiferroic $RFe_3(BO_3)_4$: Magnetostriction and thermodynamic studies — •Liran Wang[1,2], Rüdiger Klingeler[1], Natalia Tristan[1], Christian Hess[1], Bernd Büchner[1], Martin Philipp[1], Leschner Janet[1], Norman Leps[1], Olga Kataeva[1,3], Elena Popova[4], Alexander Vasiliev[4], and L.N Bezmaternykh[5] — [1]Leibniz-Institute for Solid State and Materials Research IFW Dresden,Dresden,Germany — [2]IMPRS,Dynamical Processes in Atoms Molecules and Solids,Nöthnitzer Str.38,Dresden,Germany — [3]A.E.Arbuzov Institute, Russian Academy of Science,Arbuzov Str.8,Kazan,Russia — [4]Physics Faculty,Moscow State University,Moscow,Russia — [5]L.V.Kirensky Institute of Physics,Siberian Branch of RAS, Kransnoyarsk, Russia

Rare earth ferroborates exhibit a rich phase diagram owing to the interplay 3d- and 4f-electrons. This interplay gives rise to an interesting structural and magnetic properties and it was found recently that at least two compounds of this series, i.e. R = Gd, Nd, exhibit multiferroism at low temperatures. Here, we present magnetostriction, thermodynamic and dielectric measurements on $TbFe_3(BO_3)_4$, $DyFe_3(BO_3)_4$ and $NdFe_3(BO_3)_4$ single crystals. The data show that, in the antiferromagnetically Fe-spin ordered phase below T_N at nearly 40K, there is a field induced spin-flop of the Fe spins superimposed by a spin-flip of the rare earth moments. This transition is accompanied by significant structural changes. The results are discussed in terms of a mean-field coupling model between the 3d- and the 4f-subsystem.

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Investigation of multiferroic properties in $MnWO_4$ by SHG-spectroscopy — •Michael Maringer[1], Dennis Meier[1], Thomas Lottermoser[1], Gouliang Yuan[1], Petra Becker[2], Ladislav Bohatý[2], and Manfred Fiebig[1] — [1]HISKP, Universität Bonn — [2]Institut für Kristallographie, Universität zu Köln

Magnetoelectric multiferroics, i.e. compounds displaying magnetic and ferroelectric order in the same phase, attract considerable attention from the point of view of potential device application as well as fundamental physics. In the so-called spin-spiral compounds the interaction is particularly pronounced. Here we introduce optical second harmonic generation (SHG) as a powerful tool for the study of magnetic and eletronic properties and their magnetoelectric interaction in spin-spiral compounds, taking $MnWO_4$ as an example. SHG gives detailed information about the symmetry of crystalline phases and about symmetry changes caused by phase transitions. In particular, in $MnWO_4$ the (anti)ferromagnetic incommensurate phase and the magnetically induced ferroelectric, state are investigated. Although the magnetically induced spontaneous polarization is about four orders of magnitude weaker than in a conventional ferroelectric, a pronounced SHG signal is obtained.

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Magnetoelastic coupling of $La_{0.7}Sr_{0.3}MnO_3$ films near the structural phase transition in $SrTiO_3$ — •Michael Ziese[1], Annette Setzer[1], Pablo Esquinazi[1], Ionela Vrejoiu[2], and Dietrich Hesse[2] — [1]Division of Superconductivity and Magnetism, University of Leipzig, Leipzig, Germany — [2]Max Planck Institute of Microstructure Physics, Halle, Germany

$La_{0.7}Sr_{0.3}MnO_3$ (LSMO) films were grown on vicinal (miscut angle 0.1°) $SrTiO_3$ (100) substrates by pulsed laser deposition at an oxygen partial pressure of 200 mTorr and a substrate temperature of 600°C. XRD and TEM cross-sectional investigations showed heteroepitaxial growth with excellent structural quality of the LSMO layer. Three films with thickness of 40, 15 and 5 nm, respectively, were selected for further magnetic characterization by SQUID magnetometry and ac susceptometry. In agreement with the high structural quality the films were found to be magnetically very soft with coercive fields below 1 mT near 100 K. These low coercivities enabled a detailed study of the coupling between the magnetic properties of the LSMO films and structural distortions that occur below the structural transition in the $SrTiO_3$ substrates. Below 105 K the development of a two-step transition in the magnetic response is clearly observed. This is discussed in terms of the formation of two different types of magnetic domains with different coercivities in the LSMO film as a response to twinning in the $SrTiO_3$ substrate.

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Structure and magnetism of multiferroic hexagonal $HoMnO_3$ — •Jong-Woo Kim[1], Kathrin Dörr[1], Konstantin Nenkov[1], Ludwig Schultz[1], Bas B. van Aken[2], and Manfred Fiebig[2] — [1]Institute for Metallic Materials, IFW, Dresden, Germany — [2]HISKP, Universität Bonn, Germany

Multiferroics which show more than two ferroic orders simultaneously in the same phase have got considerable attention recently due to their academic and industrial significance. Among the candidates, hexagonal $HoMnO_3$ has been revealed as most promising single-phase multiferroics for its strong magnetoelectric effect [1,2]. We have grown twin-free epitaxial $HoMnO_3$ films of thicknesses from 25 nm to 1 μm on (111) Y:ZrO_2 (YSZ) substrates by pulsed laser deposition (PLD). Mag-