Multiferroic $Sr_{1-x}Ba_xMnO_3$ Perovskite with a Huge Magnetoelectric Coupling

B. Dabrowski,[1] J. Mais,[1] O. Chmaissem,[1] S. Kolesnik,[1] E. Markiewicz,[2] V. Goian,[3] S. Kamba,[3] D.K. Pratt,[4] and J. Lynn[4]

[1] *Deptment of Physics, Northern Illinois University, DeKalb, IL, USA*
[2] *Institute of Molecular Physics, Polish Academy of Sciences, Poznan, Poland*
[3] *Institute of Physics, Academy of Sciences of the Czech Republic*
[4] *NIST Center for Neutron Research, Gaithersburg, MD, USA*

We have prepared unique multiferroic $Sr^{2+}_{1-x}Ba^{2+}_{x}Mn^{4+}O_3$ perovskite ceramics (x =0.4-0.45) for which ferroelectricity (FE, $T_F \sim 400$ K) and antiferromagnetism (AF, $T_N \sim 200$ K) originate exclusively from the Mn cations. Similar to $Ba^{2+}Ti^{4+}O_3$, the classical displacive-type ferroelectric phase transition occurs for $x > 0.4$ when the Mn ions move out of the center of the MnO_6 octahedra. These materials show on cooling a sequence of transitions from the paramagnetic (PM)/paraelectric (PE) cubic phase to the PM/FE tetragonal P4mm phase and finally to AF/PE P4/mmm phase. The largest known magneto-electric coupling was observed near T_N when ferroelectricity disappears. Because of high conductivity the measurements of complex dielectric permittivity are reliable only below 40 K, where intrinsic permittivity is about 340 and does not change with magnetic field up to 9 T. We found the AF order parameter energy gap of 4.6(5) meV and the top of the magnon band at 43(1) meV.