P10

Anomalous Hall Effect in Wide Bandgap Diluted Magnetic Semiconductors and Oxides

Y.D. Park[1,2], K.S. Suh[1], J.H. Bak[1], H.K. Choi[1], S.W. Cho[1]

[1]CSCMR & School of Physics, Seoul National University
[2]Nano Device Research Center, KIST

Since the first observations of spontaneous magnetization in (In,Mn)As and (Ga,Mn)As, anomalous Hall Effect (AHE) measurements have had a critical role in indirectly relating transport properties to the magnetic properties of diluted magnetic semiconductors (DMS). Without AHE, such novel demonstrations as electrical field control of magnetic properties in DMS would not be possible as direct magnetization measurements would be difficult.[1] Wide bandgap DMS (such as GaN) as well as oxides (such as ZnO) show promise for device application due to its relatively high T_C's, both predicted and observed.[2] Initial wide bandgap DMS and oxide systems such as (Ga,Mn)N and (Ga,Mn)P, although exhibiting high T_C, suffered from low carrier concentration as unlike (Ga,Mn)As and (In,Mn)As, Mn impurity does not readily act as source of both magnetic impurity and free carriers in the host matrix. Thusly, magnetic ordering mechanism in wide bandgap DMS is thought due to percolating networks of localized spin-polarized carriers.[3]

Magneto-transport properties, especially Hall Effect measurements, of various wide bandgap DMS and oxide systems (with and without co-dopant) will be presented. Along with wide bandgap III-V DMS and oxide systems, magneto-transport measurements of various oxides will be presented along with origins of AHE in DMS systems, in general.

1. H. Ohno *et al.*, Nature (London) **408**, 944 (2000); Y.D. Park *et al.*, Science **295**, 651 (2002); A.M. Nazmul *et al.*, Phys. Rev. B **67**, R241308 (2003).
2. S.J. Pearton *et al.*, J. Appl. Phys. **93**, 1 (2003); S.J. Pearton *et al.*, Mater. Sci. Eng., R. **286**, 1 (2003).
3. M. Berciu and R.N. Bhatt, Phys. Rev. Lett. **87**, 107203 (2001); A. Kaminski and S. Das Sarma, Phys. Rev. Lett. **88**, 247202 (2002).
4. T.H. Fukumura *et al.*, Nat. Mater. **3**, 221 (2004); S.R. Shinde *et al.*, Phys. Rev. Lett. **92**, 166601 (2004).