

応用物理学会東北支部講演会のお知らせ

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Materials Development and MuSR studies of Novel Diluted Ferromagnetic Semiconductors and Topological Superconductors

In the mid 1990's Hideo Ohno and co-workers succeeded in substituting Mn into Ga site of a III-V semiconductor GaAs by using Molecular Beam Epitaxy (MBE), opening a field of diluted magnetic semiconductors (DMS). Since then, ferromagnetic (Ga,Mn)As has been extensively studied with respect to possible applications to spin sensitive electronics (spintronics) devices. Substitution of Mn^{2+} and Ga^{3+} , however, led to limitations as (a) very small chemical solubility which prohibits availability of bulk specimens; and (b) simultaneous spin and charge doping leading only to p-type systems.

Collaborative effort by the group of Changqing Jin (IOP) and the present speaker has succeeded in synthesizing new DMS systems $\text{Li}(\text{Zn},\text{Mn})\text{As}$ (ferromagnetic Tc up to 50 K) and $(\text{Ba},\text{K})(\text{Zn},\text{Mn})_2\text{As}_2$ (Tc up to 200 K). These systems have similar/identical crystal structures with those of FeAs superconductors LiFeAs and $(\text{Ba},\text{K})\text{Fe}_2\text{As}_2$, with a very good matching of lattice parameters. Bulk specimens of these new DMS systems have already enabled NMR and neutron measurements, while future developments may allow production of n-type ferromagnets, bipolar transistors, and multilayer/interface junctions of various combinations of lattice-matched semiconductor, ferromagnet, antiferromagnet and superconductor.

In this talk, I will describe our materials developments and MuSR studies on these traditional and novel DMS systems. If time allows, I will also cover our MuSR results on "topological superconductors", including time reversal symmetry breaking of Sr_2RuO_4 , static magnetic order of $(\text{Sr},\text{Ca})_2\text{RuO}_4$ and most recent findings on bulk specimen of $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$.

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