

1P28S Electron Spin Dynamics of GaAs Surface with Manganese Adatoms Measured by Optical Pump-Probe Scanning Tunneling Microscopy

Tsukuba Univ.¹, JSPS DC1.² Z.H Wang^{1,2}, ○C.H Yoon¹, O. Takeuchi¹ and H. Shigekawa¹

Spin dynamics in diluted magnetic semiconductors (DMSs) has been a research focus both theoretically and experimentally for decades. Here we present investigation of spin dynamics at a cleaved GaAs [110] surface with manganese (Mn) adatoms by a novel scanning-tunneling-microscopy (STM)-based ultrafast measurement technique, the time-resolved optical pump-probe STM (OPP-STM) that our group has originally developed¹. Empowered by OPP-STM, we are able to observe ultrafast surface spin dynamics which are influenced by magnetic Mn impurities at nanoscale, exclusively with high temporal and spatial resolution at the same time.

As shown in Figure 1, we have observed the electron spin lifetime at GaAs [110] surface as a function of the amount of Mn deposition at room temperature. As can be seen, the spin lifetime behaved as predicted by Dyakonov-Perel spin

relaxation mechanism². Details of the experimental design as well as some other results will be introduced in the presentation.

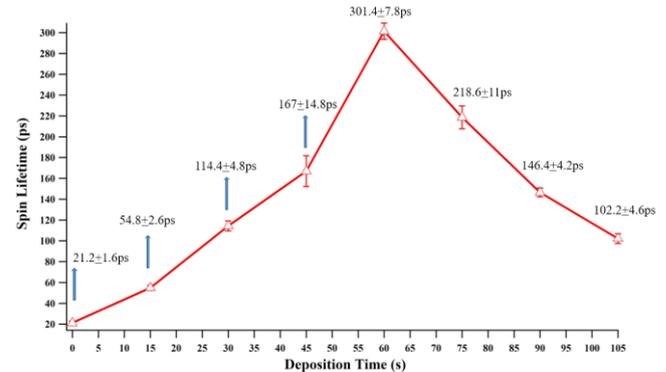


Figure 1. Electron spin lifetime variation with respect to Mn concentration on GaAs [110] surface

References

- 1) S. Yoshida, et al. *Nature Nanotechnology* 9, 588-593, 2014.
- 2) Spin Dynamics in Semiconductors, Springer, 2008.