1-D Fe-rich Konbu phase in InAs obtained by Fe ion implantation and pulsed laser melting

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Transition-metal rich semiconductor nanostructures driven by spinodal decomposition are drawing considerable attention due to wide prospects of functionalization [1]. However, the complexity of the magnetic cations aggregation (e.g. the competition between *p-d* hybridization driven attractive force between magnetic cation, entropy terms, and kinetic barriers) hinders obtaining nano-clusters with the desirable structure. Here, a 1-dimensional (In,Fe)As mixed Konbu phase is tailoring by employing ion implantation and subsequent pulsed laser melting (shown in Fig. 1). These Fe-rich nano-columns are fully commensurate with the InAs host lattice and exhibit an isotropic super-paramagnetic behavior. The XAS/XMCD result shows that Fe atoms with valence +2 and +3 are co-existing and both are spin-polarized. Therefore, it is likely that the magnetism in these Fe-rich nano-columns can be provided via the double exchange mechanism as previously described for the Cr-rich phase in (Zn, Cr)Te [2]. However, it still remains to be clarified why these distinctive structures are formed only in InAs: Fe, but not in other III-Mn-V systems obtained by the same method.

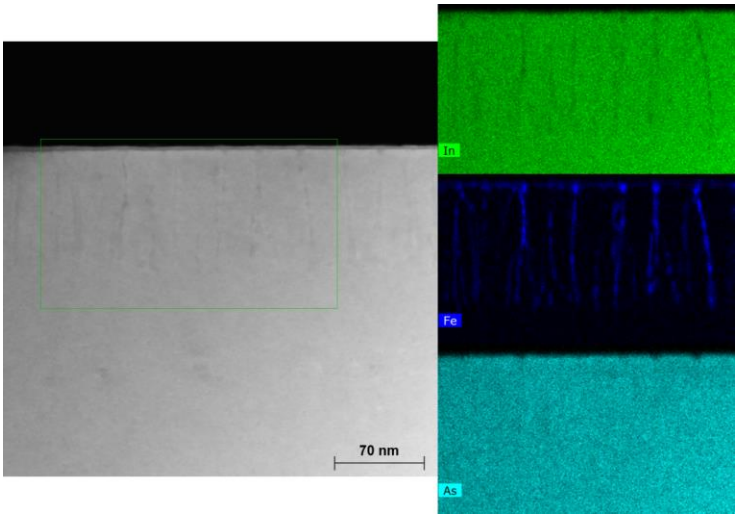

Fig. 1. Cross-sectional TEM image of the (In, Fe)As sample after PLM, and the insets show the EDXS (green: In, deep blue: Fe, and light blue: As) mapping images of the selected region.

[1]. T. Dietl, et al., *Rev. Mod. Phys.*, **87**, 1311-1377 (2015)

[2]. K. Kanazawa, et al., *Nanoscale*, **6**, 14667-14673 (2014)