# Structural and Magnetic Properties of hybrid GaAs Nanowires with MnGa and MnAs shells determined by advanced TEM methods

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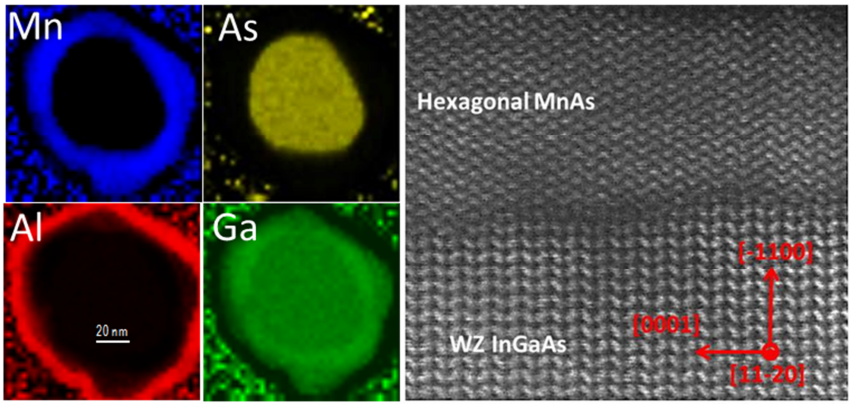
Ferromagnetic nanowires are potential candidates for new types of nano-scale magnetic memory applications (magnetic racetrac memories [1]). Since the bottom-up methods of NWs growth are the most advanced for semiconducting materials, one of the possible ways of realization of such structures is to use template semiconductor core nanowires overgrown with ferromagnetic metal shells. We investigate two examples of such hybrid nanostructures: (In,Ga)As NWs with MnAs and MnGa shells. Both shell compounds are metallic ferromagnets with high Curie temperatures of 40 °C and 300 - 350 °C (depending on stoichiometry), respectively

The structure and magnetic properties of core-shell nanowires are studied using HRTEM, STEM, scanning diffraction and electron holography. The low defect density (In,Ga)As NW cores have been grown by MBE using Au-catalyst pre-deposited on GaAs(111)B substrates. Two type of magnetic shells epitaxially deposited MnAs and GaMn have been investigated. The off-axis Lorentz holography has been applied to study magnetic properties of such NWs at nano-scale. Atomic scale investigation of shell/core interface has been performed using FIB cross-section of NWs and exit wave reconstruction of defocused image series. The Burgers vectors of the interface misfit dislocations have been determined by dislocation density tensor analysis.

(a)




(b)

Figure.1 (a) EDS maps of FIB cross-section of GaAs NW with GaMn shell and oxidation protective Al shell. (b) High Resolution STEM image of the interface between wurtzite (In,Ga)As NW core and MnAs shell.

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[1] S. S. P. Parkin, M. Hayashi, L. Thomas, *Science,* **320**, 190 (2008).