Synthesis and magnetic properties of Zn$_{1-x}$Mn$_x$O/ZnO coaxial nanocables. D. WANG, S. PARK, Y. LEE, T. EOM, Y. LEE, q-Psi and BK21 Program Division of Advanced Research and Education in Physics, Hanyang University, Seoul, Korea — Zn$_{1-x}$Mn$_x$O/ZnO ($x=0.04$ and 0.20) coaxial nanocables were prepared by using an ultrahigh-vacuum radio-frequency magnetron sputtering system. The samples were characterized by scanning electron microscopy (SEM), x-ray diffraction (XRD), Rutherford backscattering and high-resolution transmission electron microscopy (HR-TEM), and with a superconducting quantum interference device magnetometer. The SEM images show that the morphology and the alignment of ZnO nanocables are maintained after the deposition of Zn$_{1-x}$Mn$_x$O layer, and the thickness of Zn$_{1-x}$Mn$_x$O layer is about 20 nm. The XRD analysis reveals that Mn is incorporated well into the wurtzite ZnO without forming Mn oxide. The HR-TEM image shows that both ZnO core layer and Zn$_{1-x}$Mn$_x$O shell layer are single crystalline and an excellent epitaxial growth has been achieved. The magnetic property measurement indicates that the Zn$_{0.96}$Mn$_{0.04}$O/ZnO coaxial nanocable is in the ferromagnetic state at 300 K as well as at 10 K, while Zn$_{0.80}$Mn$_{0.20}$O/ZnO is nonferromagnetic even at 10 K and the bare ZnO nanorod is diamagnetic. The aging effect of the magnetism for Zn$_{0.96}$Mn$_{0.04}$O/ZnO coaxial nanocable was also investigated, and it was found that the aged sample showed a mixed magnetic phase of ferromagnetism and paramagnetism.