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Observation of large spin splitting in the conduction band of n-type ferromagnetic semiconductor (In,Fe)As[1] LE DUC ANH, The University of Tokyo, PHAM NAM HAI, Tokyo Institute of Technology, MASAAKI TANAKA, The University of Tokyo — Ferromagnetic semiconductors (FMSs) both with large spin-split conduction band (CB) and valence band (VB) and with high Curie temperature (T_C) are highly desired for spintronic devices, which is not yet realized so far. Here, we report the first observation of large spontaneous spin splitting (ΔE =50 meV) in the CB of n-type FMS (In,Fe)As using tunneling spectroscopy in (In,Fe)As-based Esaki diodes. The device structure consists of 50 nm-thick n^+(In,Fe)As/5 nm-thick InAs/250 nm-thick p^+ InAs:Be grown on a p^+InAs(001) substrate. At small forward bias voltages, electrons tunnel from the (In,Fe)As CB to the p^+InAs VB, thus the tunneling conductance dI/dV probes the density of states of the (In,Fe)As CB. In the $d^2I/dV^2 - V$ curves, we clearly observe double-valley features at low temperatures, which evolve into single-valley features at temperatures above T_C of the (In,Fe)As films. This is clear evidence of the spin splitting of the (In,Fe)As CB bottom. We found that the mean-field Zener model also fails to explain consistently the T_C and ΔE of (In,Fe)As. [1] L. D. Anh et al., Nature Communications (2016), arXiv:1609.01379.

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