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A Designed Room Temperature Multilayered Magnetic Semiconductor DINAH SIMONE BOUMA, MICHALIS CHARILAOU, CATHERINE BORDEL, UC Berkeley Physics Department, RYAN DUCHIN, UC Berkeley Materials Science and Engineering Department, ALEXANDER BARRIGA, ADAM FARMER, FRANCES HELLMAN, UC Berkeley Physics Department, MATERIALS SCIENCE DIVISION, LAWRENCE BERKELEY NATIONAL LAB TEAM
— A room temperature magnetic semiconductor has been designed and fabricated by using an epitaxial antiferromagnet (NiO) grown in the (111) orientation, which gives surface uncompensated magnetism for an odd number of planes, layered with the lightly doped semiconductor Al-doped ZnO (AZO). Magnetization and Hall effect measurements of multilayers of NiO and AZO are presented for varying thickness of each. The magnetic properties vary as a function of the number of Ni planes in each NiO layer; an odd number of Ni planes yields on each NiO layer an uncompensated moment which is RKKY-coupled to the moments on adjacent NiO layers via the carriers in the AZO. This RKKY coupling oscillates with the AZO layer thickness, and it disappears entirely in samples where the AZO is replaced with undoped ZnO. The anomalous Hall effect data indicate that the carriers in the AZO are spin-polarized according to the direction of the applied field at both low temperature and room temperature. NiO/AZO multilayers are therefore a promising candidate for spintronic applications demanding a room-temperature semiconductor.

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