MAR05-2004-000303

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Ferromagnetic resonance studies of dilute magnetic semiconductors[1]

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We describe ferromagnetic resonance (FMR) measurements on ferromagnetic $II_{1-x}Mn_xVI$ semiconductor alloys in thin film form. These include $Ga_{1-x}Mn_xAs$ layers grown by low-temperature molecular beam epitaxy on various buffers used to obtain different strain conditions. The analysis of the FMR provides values of cubic and uniaxial magnetic anisotropy fields – i.e., those associated with the natural (undistorted) zinc-blende structure, and those arising from strain. Similar studies were also carried out on $In_{1-x}Mn_xAs$, providing analogous information. Finally, we applied the FMR technique to $Ga_{1-x}Mn_xAs/Ga_{1-y}Al_yAs$ heterostructures modulation-doped by Be. Here it was found that the increase in doping – in addition to raising the Curie temperature of the $Ga_{1-x}Mn_xAs$ layers – also leads to a significant increase of their uniaxial anisotropy field. The FMR data for modulation-doped heterostructures further show that the effective g-factor of $Ga_{1-x}Mn_xAs$ is strongly affected by the doping, thus providing a direct estimate of the free hole contribution to the magnetization of $Ga_{1-x}Mn_xAs$.

[1]In collaboration with X. Liu, T. Wojtowicz, and K. Dziatkowski