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Frontiers for Ferromagnetism in GaMnAs

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By careful control of MBE growth conditions and post growth annealing procedures we have produced GaMnAs epilayers which high conductivities and Curie temperature up to 173K. We demonstrate that the improvement in material properties resulting from annealing is due to the out diffusion of interstitial Mn. The high conductivies of our material makes it possible to obtain accurate hole densities for a range of Mn compositions and to make meaningful quantitative comparisons of magnetic and transport properties with theoretical predictions. We find that compensation is very low in best samples. We show that our measured Curie Temperatures, Hall conductivities and AMR are in good agreement with the mean field theory. We also find that there is no evidence of a fundamental magnetisation deficit in our material. We will also present the observation of a large tunneling anisotropic magnetoresistance (TAMR) in thin (Ga,Mn)As epilayers with lateral nanoconstrictions. The observation establishes the generic nature of the recently discovered TAMR effect, which originates from spin-orbit coupling in a ferromagnet and is not specific to a particular tunneling geometry. The lateral geometry allows us to directly link normal anisotropic magnetoresistance (AMR) and TAMR. This indicates that TAMR may be observable in other materials showing room temperature AMR, and suggest a re-examination of previous tunneling and nanocontact results.