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Optically Pumped NMR Studies of Mechanically Induced Strain in GaAs Films CLIFFORD BOWERS, RYAN WOOD, JOHN TOKARSKI III, LAUREN MCCARTHY, DIPTA SAHA, CHRISTOPHER STANTON, Univ of Florida - Gainesville, JESUS MORENO, MIT — We present a new methodology for measuring strain in semiconductor films based on optically pumped NMR (OPNMR). Single crystals of GaAs were epoxy bonded to Si wafers at 100 °C. The GaAs is then variably thinned by selective chemical etching. Upon cooling, biaxial tensile strains are induced in the GaAs films since the coefficient of thermal expansion in GaAs is different than in the Si support. OPNMR experiments were carried out at 6-10 K. The OPNMR spectra are selective to nuclei within a photon penetration depth from the surface. When mounted on a 0.635 mm thick Si support, the strain, which is proportional to the observed quadrupole splitting, is found to decrease with increasing thickness of the GaAs films and appears to approach a residual value. When the same GaAs film is mounted on a thicker 5mm Si block, the strain increased. To explain the observations, we consider effects of dislocation relaxation of strain and bending of the composite. The interface strain extracted from the measurements is 5.5×10^{-4}, in good agreement with the value estimated using the differential thermal contraction of Si and GaAs. The strain resolution of the technique is about 10^{-5} in GaAs.

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