Magnetoresistance Measurements of Modulation Doped Si/$Si_{0.8}Ge_{0.2}$ Structure Grown by Molecular Beam Epitaxy (MBE) Technique

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Magnetoresistance oscillations are obtained in the inverted modulation doped molecular beam epitaxy (MBE) grown Si/$Si_{0.8}Ge_{0.2}$ sample. The variation of the longitudinal resistivity ρ_{xx} (at B=0) and sheet conductivity σ_{xx} with temperature has been found. The 2D hole denstiy per well has been calculated from the plots of the reciprocal magnetic field (1/B). In these structures a quasi-two dimensional hole gas (2DHG) was formed in the $Si_{0.8}Ge_{0.2}$ quantum wells with 4.2 K sheet carrier denstiy measured in the range (2.5 x 6.5) x 10^{11} cm^{-2}.

Magnetotransport measurements of the longitudinal sheet resistivity ρ_{xx} and Hall resistance ρ_{xy} were made in the range B = -0.5 – 12 T and T = 0.330 – 1.5 K. At 0.3 K, Hall mobility is 4070 $cm^2V^{-1}s^{-1}$. From SdH (Shubnikov-de Haas oscillations) low temperature magnetotransport measurements in the temperature range 332 mK - 2.5 K, the role effective mass $m^* = (0.26 \pm 0.01)\ m_0$ was extracted for the corresponding carrier density of n_s = 3.8 x 10^{11} cm^{-2}.

The experimental thermopower and thermal conductivity measurements have been carried in the temperature range 1.4 – 300 K. The thermoelectric power is found to be dominated by the phonon drag contribution in the range 1.4 – 20 K. A fit to phonon drag thermopower theory for $Si_{0.8}Ge_{0.2}$/Si heterostructures yields a value of 4.5 eV for the acoustic phonon deformation potential. The phonon mean free paths of the structures have been calculated from the thermal conductivity measurements.