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Carbon doped symmetric GaAs/AlGaAs quantum wells with hole mobilities beyond 10^6 cm^2/Vs

C. Gerl, S. Schmult, H.- P. Tranitz, C. Mitzkus, W. Wegscheider
Universität Regensburg, Institut für Experimentelle und Angewandte Physik, 93040 Regensburg

Abstract :
Utilizing a novel carbon doping source, we prepared two-dimensional hole gases in a symmetric quantum well structure in the GaAs/AlGaAs heterosystem. Low temperature hole mobilities up to 1.2 x 10^6 cm^2/Vs at a density of 2.3 x 10^{11} cm^{-2} were achieved on GaAs (001) substrates. In contrast to electron systems, the hole mobility sensitively depends on variations of the quantum well width and the spacer thickness. In particular an increase of the quantum well width from an optimal value of 15 nm to 18 nm is accompanied by a 35 % reduction of the hole mobility. The quality of ultrahigh-mobility electron systems is not affected by the employed carbon doping source.

Fig. 3:

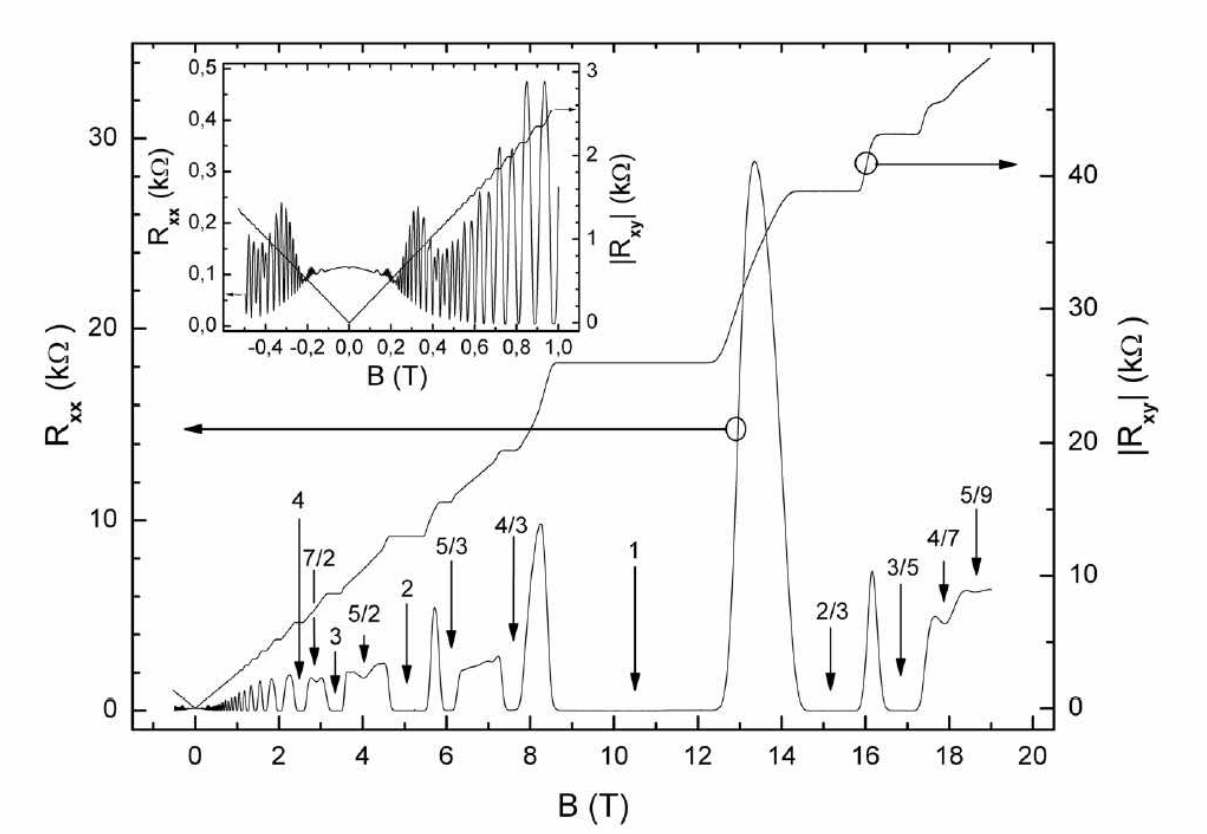

Fig. 3: Longitudinal and Hall resistance at a bath temperature <30 mK (Sample A). The Hall bar has a length of 1 mm and a width of 200 µm.
The mobility is 1.2 x $10^6 cm^2/Vs$ at a density of 2.3 x 10^{11} cm^{-2}.
Inset: Low magnetic field (-0.5 T < B < 1 T) Shubnikov-de-Haas oscillations and according Hall measurement.