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Development of high quality, density-tunable two-dimensional electron gases for the study of the quantum Hall effect in the 2nd Landau level[1] JOHN WATSON, SUMIT MONDAL, Department of Physics and Birck Nanotechnology Center, Purdue University, MICHAEL MANFRA, Departments of Physics, Electrical and Computer Engineering, and Materials Engineering and Birck Nanotechnology Center, Purdue University — We report on progress in state-of-the-art high mobility two-dimensional electron gases (2DEGs) in 30 nm GaAs/AlGaAs quantum wells in which the density is modulated by an in-situ grown back-gate. Such in-situ gates can be grown close to the 2DEG ($\sim$ 1 μm) and without doping layers between the 2DEG and gate, resulting in non-hysteretic gating with a very uniform electric field and large gate capacitance. We discuss heterostructure design parameters and device processing conditions leading to low gate leakage currents, low ohmic contact resistances, high electron mobilities (17 x 10^6 cm^2/Vs), and large fractional quantum Hall energy gaps in the second Landau level.

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