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Investigation of two-dimensional electron systems at low density on hydrogen-terminated silicon (111) surface BINHUI HU, TOMASZ M. KOTT, B. E. KANE, University of Maryland — Two-dimensional electron systems (2DESs) on hydrogen-terminated Si(111) surfaces show very high quality. The peak electron mobility of 325,000 cm^2/Vs can be reached at T=90 mK and 2D electron density $n_{2d} = 4.15 \times 10^{11}$ cm^{-2} , and the device shows the fractional quantum hall effect[1]. 2DESs on H-Si(111) at lower densities may exhibit new physics, because both valley degeneracy and effective mass lead to a large Wigner–Seitz radius r_s at accessible densities. In these devices, phosphorus ion implantation is used to defined the contacts to the 2DESs[2]. The contacts themselves work at low temperature. However, at lower 2D electron density ($< 2 \times 10^{11}$ cm^{-2}) and low temperature (<1 K), the contact resistance to the 2DESs shows strong temperature dependence. This makes accurate Hall measurements difficult in this region. We have systematically investigated the contact resistance at different electron densities and temperatures. Different ion implantation annealing parameters are adjusted to mitigate the issue. Possible measurement technique is also explored to overcome the problem. [1] Tomasz M. Kott, Binhui Hu, S. H. Brown, and B. E. Kane, arXiv:1210.2386 (2012) [2] K. Eng, R. N. McFarland, and B. E. Kane, Appl. Phys. Lett. 87, 052106 (2005)

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