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Superconductivity in Quasi-2D Electron System with Ultra-high Electron Density ADAM NEAL, HONG ZHOU, YUCHEN DU, PEIDE YE, Birck Nanotechnology Center and Electrical and Computer Engineering, Purdue University — Superconductivity is widely observed in transition metals, but not easily obtained in conventional semiconductors such as Si or III-V compound semiconductors. Here we report the first electrical experiments performed at room pressure on a set of AlInN/AlN/GaN heterojunction samples with different electron doping concentrations. The state-of-the-art AlInN/AlN/GaN 2DEG grown by MOCVD for GaN HEMT applications has a high electron density of $2 \times 10^{13}/\mathrm{cm}^2$ and it can be increased to $7 \times 10^{15}/\mathrm{cm}^2$ by solid metal doping. With such 2-3 orders of magnitude higher electron density, superconducting state has been observed in the conventional III-V semiconductors with $T_c \sim 1$K and two-step H_c of 0.3T and 1.5T with magnetic field parallel to the sample surface and H_c of 0.1T and 0.8T with magnetic field perpendicular to the sample surface. Angular dependence H_c reveals the quasi-2D nature of the electron system. More details of these new experiments related with superconducting III-V semiconductors will be presented.

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