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Influence of gate width on gate-channel carrier mobility in AlGa_N/Ga_N heterostructure field-effect transistors

Ming Yang ^a, Qizheng Ji ^{a,*}, Zhiliang Gao ^a, Shufeng Zhang ^a, Zhaojun Lin ^b, Yafei Yuan ^a, Bo Song ^a, Gaofeng Mei ^a, Ziwei Lu ^a, Jihao He ^a

^aBeijing Orient Institute of Measurement and Test, Beijing 100094, China

^bSchool of Microelectronics, Shandong University, Jinan 250100, China

Abstract

For the fabricated AlGa_N/Ga_N heterostructure field-effect transistors (HFETs) with different gate widths, the gate-channel carrier mobility is experimentally obtained from the measured current-voltage and capacitance-voltage curves. Under each gate voltage, the mobility gets lower with gate width increasing. Analysis shows that the phenomenon results from the polarization Coulomb field (PCF) scattering, which originates from the irregularly distributed polarization charges at the AlGa_N/Ga_N interface. The device with a larger gate width is with a larger PCF scattering potential and a stronger PCF scattering intensity. As a function of gate width, PCF scattering potential shows a same trend with the mobility variation. And the theoretically calculated mobility values fits well with the experimentally obtained values. Varying gate widths will be a new perspective for the improvement of device characteristics by modulating the gate-channel carrier mobility.

Key words—AlGa_N/Ga_N HFETs; gate width; carrier mobility

* Corresponding author.

E-mail address: qzhji@sina.com (Q. Ji).

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