Optimization of AlGaN/GaN EdgeFETs for terahertz detection by regrowth of ohmic contacts

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Field-effect transistors (FETs) can act as terahertz (THz) detectors or emitters [1]. Signal and cut-off frequency of THz FET detection depend on the RC product (C is the gate capacitance and R represent the Ohmic losses).

In order to reduce the capacitance, we fabricated AlGaN/GaN FET with two gates that are located along the edges of the channel and that are contacted directly to the two-dimensional electron gas (2DEG) [2], thus forming Schottky contact between the gate metal and the 2DEG. The area of each Schottky gate in this kind of the transistor (EdgeFETs) is extremely small and is within the range of (1-4)x10^{-13}cm^2 depending on the gate width. With the help of two lateral gates we are able to narrow the channel and allow propagation of plasma waves only in one direction. This should lead to resonant THz detection [2].

In order to reduce the Ohmic losses we used regrown ohmic drain and source contacts (Fig.1b).

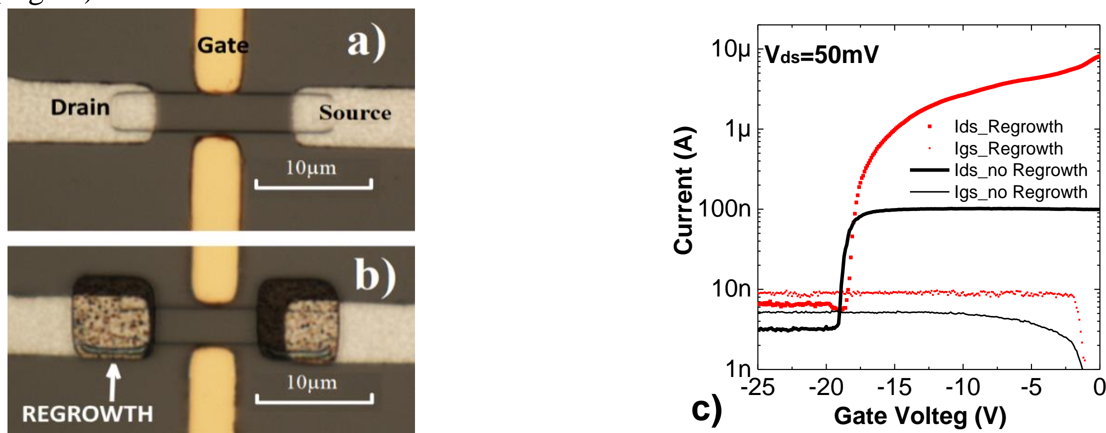

Fig. 1. EdgeFETs without regrowth a) and with regrowth b). c) Transport characteristics of EdgeFETs and gate leakage current.

The EdgeFETs contact resistance was significantly improved by regrowth as shown in Fig. 1c. At the same time both samples show similar threshold slope. Accordingly [3] this will result in much higier detection signal registered in the case of sample with regrown contacts. As a rersult we show great improvement in the EdgeFETs quality, which approach us towards resonant THz detection.

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