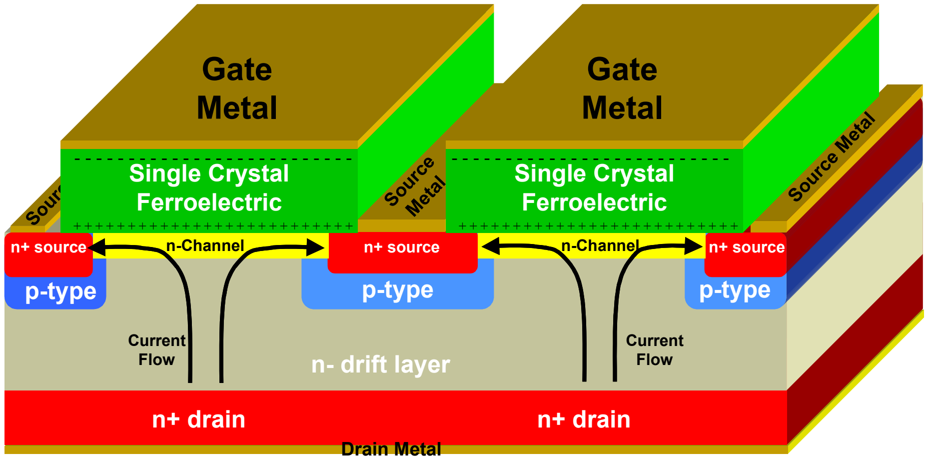
Novel Power Transistor based on Ferroelectric Oxides



Goals and Objectives

•Increase current handling capability by decreasing the on-resistance of traditional MOS SiC switching devices by achieving material advances such as

- •Higher Charge density by factors of 100-1000 compared to traditional SiC MOS technology
- •Improved effective channel mobility

•Provide transistors with static operation: Once switched off, the device stays off until turned back on

Main Technical Approach

Combine polarization discontinuity based device design and the extreme control of molecular beam epitaxy using novel growth chemistry to facilitate growth of patterned epitaxial lithium niobate on silicon carbide

Major Technical Accomplishments

•Demonstrated growth of both components of lithium niobate (niobium oxide and lithium oxide) using novel chemistry. This includes:

- •Commissioned and debugged MBE epitaxy system designed for lithium niobate
- •Demonstrated ability to deliver both niobium oxide and lithium oxide with the level of control required for lithium niobate epitaxy
- •Demonstrated ability to pattern lithium niobate gates using molybdenum “lift off technology”.

Major Work Remaining to Completion of Contract

•Demonstrate functional crystalline lithium niobate MOS capacitors and transistors on SiC.

•Characterize the device performance improvements with the goal of 0.01 Ω-cm^2 series resistance in an MOS device.

Major Impact of Technology

When successful, the power handling capability of SiC based power devices should be improved by a factor of 100-1000. This will allow increased usage of all-electric drive capabilities in military vehicles.

Technology Transition Plan

When successful, the commercial technology used herein will be made available under license agreement to various power electronics companies. Discussions in this regard have been initiated, but are currently premature.