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The road towards the ferroelectric-FET – Carrier density modulation by ferroelectric switching in $BaTiO_3$/Ge PATRICK PONATH, KURT FREDRICKSON, AGHAM POSADAS, YUAN REN, XIAOYU WU, RAMA VASUDEVAN, Univ of Texas, Austin, BARIS OKATAN, STEPHEN JESSE, Oak Ridge National Laboratory, TOSHIHIRO AOKI, MARTHA MCCARTNEY, DAVID SMITH, Arizona State University, SERGEI KALININ, Oak Ridge National Laboratory, KEJI LAI, ALEX DEMKOV, Univ of Texas, Austin, PONATH, FREDRICKSON, POSADAS, DEMKOV TEAM, REN, WU, LAI COLLABORATION, VASUDEVAN, OKATAN, JESSE, KALININ COLLABORATION, AOKI, MCCARTNEY, SMITH COLLABORATION — Germanium, with its higher hole and electron mobility is a potential candidate to replace silicon as a channel material in a field effect transistor in the future. The ferroelectric high-k dielectric barium titanate (BTO) can be integrated on germanium (001) due to the small lattice mismatch between BTO and Ge and could therefore be a potential candidate for a ferroelectric memory. We report the epitaxial growth of BTO on a germanium (001) substrate with a thin STO buffer layer, which imposes compressive strain on BTO and causes it to be out of plane polarized. The BTO film crystallizes as-deposited which is monitored by RHEED. XRD measurements of the BTO film indicate an out-of-plane ferroelectric polarization which can be confirmed by piezoresponse force microscopy. Using microwave impedance microscopy we could show that we can effectively modulate the charge in germanium; this charge modulation constitutes the field effect, which is an important step towards the development of a ferroelectric-FET.

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