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Selective area growth of $BaTiO_3$ for ferroelectric field-effect transistor application PATRICK PONATH, AGHAM POSADAS, Univ of Texas, Austin, MICHAEL SCHMIDT, PAUL HURLEY, RYAN DUFFY, University College Cork, JIAN WANG, CHADWING YOUND, University of Texas at Dallas, ALEX DEMKOV, Univ of Texas, Austin — Titanates are an important class of materials with many interesting functional properties and applications for non-volatile memory, i.e. $BaTiO_3$, which is a promising candidate for the realization of a ferroelectric field-effect transistor. However, the difficulty of chemically etching titanates has hindered their commercial use in device manufacturing so far. Here, we propose a technique to circumvent this problem. Using molecular beam epitaxy, we grew compressively strained ferroelectric $BaTiO_3$, within photolithographically defined openings of a sacrificial SiO_2 layer on germanium (001) and strontium titanate (001). Etching away the sacrificial SiO_2 can reveal isolated nanoscale gate stacks circumventing the need to etch the titanate thin film. Different SiO_2 processing techniques are compared for Ge(001) and Nb:STO(001) substrates and the thermal stability of the SiO_2 pattern as well as the resulting surface roughness after a thermal anneal will be reported. Using X-ray diffraction we find that the $BaTiO_3$ film is tetragonal with the longer c-axis being out of plane, which is a requirement for the ferroelectric field effect transistor. The crystal quality of the $BaTiO_3$ films grown in the openings is confirmed using RHEED and cross-sectional transmission electron microscopy.

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