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Integrated silicon nanophotonics: structure and electro-optic properties of $BaTiO_3$ on Si(001) KRISTY KORMONDY, University of Texas at Austin, FLORIAN FALLEGGER, STEFAN ABEL, YOURI POPOFF, IBM Research - Zurich, PATRICK PONATH, AGHAM POSADAS, University of Texas at Austin, MARILYNE SOUSA, DANIELE CAIMI, HEINZ SIEGWART, EMANUELE UCCELLI, LUKAS CZORNOMAZ, CHIARA MARCHIORI, JEAN FOMPEYRINE, IBM Research - Zurich, ALEXANDER DEMKOV, University of Texas at Austin — High-quality epitaxial $BaTiO_3$ (BTO) on Si has emerged as a promising material for future electro-optic (EO) devices based on BTO's large effective Pockels coefficient. In order to achieve strong EO coupling, a film must have (1) correct crystallographic orientation with respect to the applied electric field, and (2) low leakage current in the film to sustain a strong electric field. We report on the EO response of BTO films deposited on Si by molecular beam epitaxy. O_2 rapid thermal anneal at 600C for 30 min ensures full oxidation of BTO for minimal leakage current with minor change in crystalline structure. EO characterization was performed by analyzing changes of the polarization of a laser beam transmitted through pairs of lithographically defined electrodes. The EO response shows signatures of ferroelectric domains with in-plane polarization. Comparison with normalized responses of c-axis and a-axis films illustrate that a strong EO response is observed even for a mixed film. These results quantify the relationship between BTO structure and EO properties, an important step towards future silicon photonic devices based on ferroelectric oxides.

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