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Silicon-on-insulator for symmetry-converted growth Y. FUJIKAWA, Y. YAMADA-TAKAMURA, G. YOSHIKAWA, Institute for Materials Research, Tohoku University, T. ONO, M. ESASHI, Faculty of Engineering, Tohoku University, P. ZHANG, M. G. LAGALLY, University of Wisconsin-Madison, T. SAKURAI, Institute for Materials Research, Tohoku University — Because of its well-established processability, good electronic-transport properties, and ability to form a stable insulating oxide, silicon will remain the essential semiconductor for fabrication of electronic devices. Most device fabrication uses Si(001) and hence most of fundamental research, including heteroepitaxy and integration, has focused on Si(001), a square lattice. Materials having 3- or 6-fold symmetries, a major and important class with key properties, have intrinsic difficulty in their growth on Si(001) because the symmetry mismatch induces polycrystallization at the interface and degrades the film quality. We present a general solution for this long-standing problem that allows maintaining the Si(001) bulk material for those aspects of device fabrication that require it while making possible the growth of 3-fold symmetric structures. We utilize silicon-on-insulator (SOI) in which Si(111) is bonded to Si (001). A 14 nm-thick Si(111) template layer is bonded to Si(001) via the buried oxide. Using the surface preparation method recently developed for the Si(001)-SOI surface, this SOI structure provides a uniform Si(111)-7x7 clean surface. Wurtzite GaN is grown directly on this SOI structure, forming of uniform N-polar film.

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