

Problem 1400-10

The growth of GaAs on Si, has some advantages. What might that be? Hetero-epitaxi with Si as a substrate has been extended to other materials than GaAs. Among these are InP , CdTe and HgCdTe. For each discuss what merits may be involved. If you would extend it to other/new materials, what would you need to find out to determine whether it would be technically feasible to grow the material epitaxially on Si?

Solution

The growth of GaAs on Si, has some advantages. What might that be?

See lecture: Large area wafer for processing.

Active optical component integration with Si,

Very high speed integration with Si.

InP/Si: Large area wafer, Very High Speed integration,

Devices lattice match InP , InGaAs

Si/CdTe: Substrate for HgCdTe, Solar cell growth, CdTe thin

HgCdTe: IR detection, Si processing of signals.

New materials. A) lattice constant at growth temperature. B_ Growth temperature. Thermal expansion coefficient. Reactivity with Si.

Regarding InP growth on Si

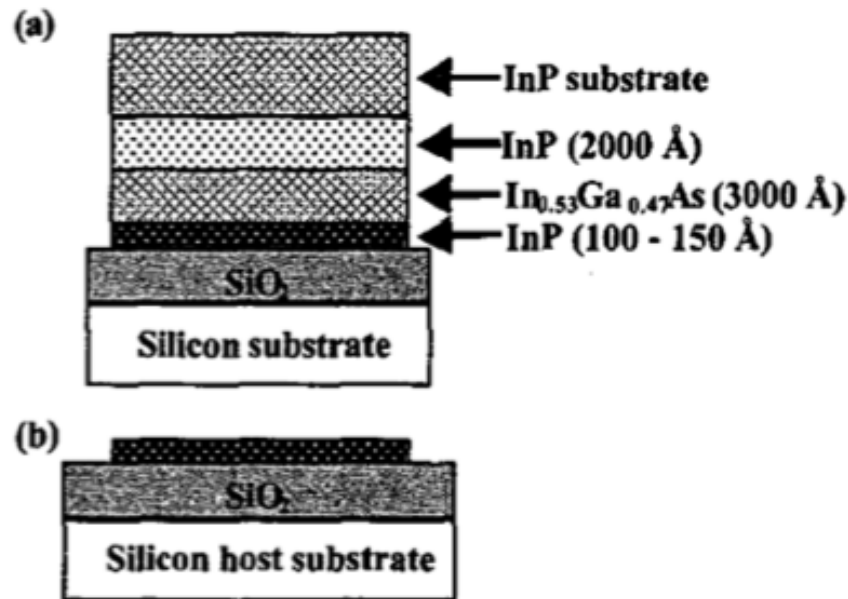


Fig. 1. Key technological steps for obtaining thin InP seed layer on Si host substrate.

(a) MBE growth of III-V structure on InP substrate and upside down bonding on silicon substrate via SiO_2

(b) Back-etching of the sacrificial layers and substrate.

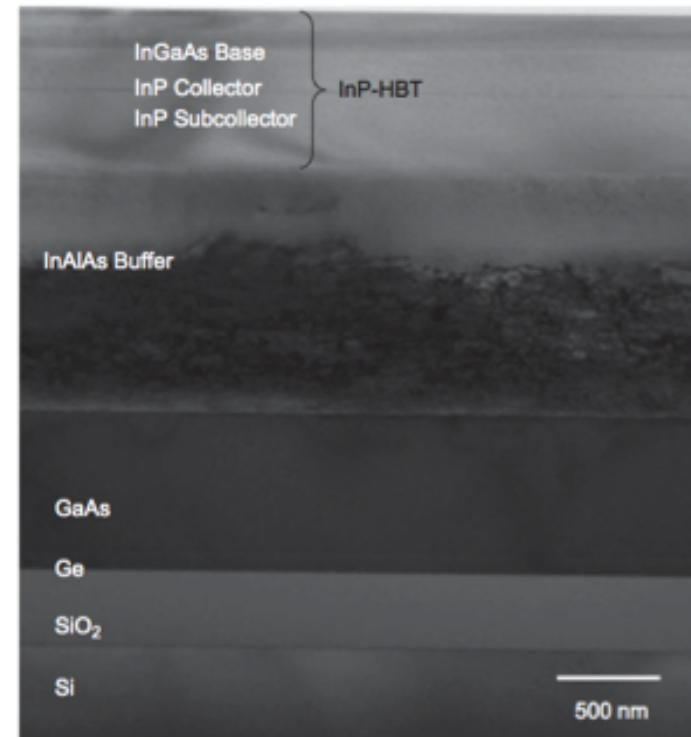


Fig. 2. Cross-sectional TEM image of an InP-HBT structure grown on an un-patterned GeO/Si substrate.

High quality epitaxial growth on new InP/Si substrate.

M. Kostrzewa IEEE 0-7803-7704-4/03

W.K. Liu, et al., J. Crystal Growth (2008), doi:10.1016/j.jcrysgro.2008.10.061

Chip level integration of III-V devices with Si-CMOS platform requires the use of engineered substrates. Fabrication of engineered substrates utilizes technologies such as epitaxy, wafer bonding and layer transfer.