A Virtual Substrate on Si Formed by Ion Implantation for Growing a Variety of Heterostructures.*

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The ability to form a wide variety of heterostructures on Si is critical for enhancing the function of integrated circuits. The “Holy Grail” of optoelectronics is to integrate GaAs and Si on a single platform to provide both optical and digital functionality. Also, pseudomorphic Ge_xSi_{1-x} heterostructures exhibit greatly increased carrier mobilities due to strain. Since GaAs is almost perfectly lattice-matched to Ge, a virtual substrate (VS) on Si suitable for growth of Ge_xSi_{1-x} films of arbitrary composition could easily be adapted for a wide variety of III-V heterostructures. A method of forming such s VS involving oxidation of Ge-implanted Si and silicon-on-insulator (SOI) will be discussed. Segregation of Ge during oxidation produces an enriched layer of Ge at the growth interface with a composition that depends upon processing conditions. In the case of SOI, the buried interface will be shown useful in encapsulating the segregated film between the top- and buried-oxide layers to decouple the film from the Si substrate to promote relaxation. Characterization of the films will be discussed as well as methods to achieve pseudomorphic and relaxed structures.

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