GaAs/Ge heterostructures : Physics and Technology

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GaAs/Ge epitaxial heterostructures have received lots of attention as starting materials for the fabrication of space quality solar cells and the potential application in electronic and optoelectronic devices. A polar-on-nonpolar heterojunction diode presents two problems, namely, antiphase domains (APDs) formation in the epitaxial polar semiconductor, and cross diffusion at the heterointerface, which leads to uncontrolled doping on both sides of the junction. A number of reports in the literature examine cross diffusion at the GaAs-Ge heterointerface, yet there is not much work reporting on the electrical characteristics of isotype heterojunction n-GaAs on n-Ge diodes. The main problem of the formation of the misfit dislocations (MDS) due to the difference in lattice constant between GaAs and Ge , and formation of p-n junction in the Ge substrates, from the interdiffusion of elements (Ga, As into Ge, Ge into GaAs), affects the solar cell performance. In this paper, we will report the results from the MOVPE growth of GaAs on Ge substrates and their detailed structural, optical and electrical transport characteristics.