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Growth Mode of Si_{0.5}Ge_{0.5} Epitaxial Layer on Si (100) by Ion Beam Assisted DepositionS.W. Park, J.Y. Shim and H.K. Baik

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The nucleation and growth of the Si_{0.5}Ge_{0.5} alloy layer on Si (100) substrate during Ion Beam Assisted Deposition (IBAD) have been investigated by atomic force microscopy, reflection high energy electron diffraction, transmission electron microscopy and double crystal rocking diffraction. It is confirmed that Si_{0.5}Ge_{0.5} nucleates on Si (100) via the Stranski-Krastanov (SK) mechanism. Ar ion bombardment with an energy level of 300 eV and beam current density of 10 $\mu\text{A}/\text{cm}^2$ prolonged layer-by-layer stage in the SK growth mode and improved crystalline perfection. The epitaxial growing temperature of the SiGe film was 200 °C, which is much lower than that of MBE, and the χ_{\min} value was 10.5% lower than the MBE value. The effect of ion bombardment on nucleation was explained as being the ion bombardment-induced dissociation of three dimensional islands and enhanced surface diffusion, and appeared only at low deposition temperatures where the dissociation of three dimensional islands is more favorable than the formation of those islands.