Composition control and the effect of buffer layer in InAsSb epilayers grown by Hot Wall Epitaxy

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Epitaxial growth of $InAs_xSb_{1-x}$ alloy is of practical interest for potential applications to optoelectronic devices such as lasers, detectors etc., in the infrared region of 3.5 ~ 12 μm due to high thermal stability and high speed response of the devices. Since the vapor pressures of In, As and Sb elements are quite different, the composition control of $InAs_xSb_{1-x}$ is a difficult task. Therefore, As temperature is varied under the optimized temperatures of GaAs substrate, In and Sb sources. In this method, it is succeeded to control the As composition of the alloy in a wide range from 0 to 1.

High quality $InAs_xSb_{1-x}$ alloy is achieved by employing the growth of buffer layers. It is found that x-ray intensity of the alloy is increased about three orders of magnitude and the x-ray rocking curve line-width is decreased to a factor of one fifth when compared to that of the alloy directly grown on GaAs. Further, Hall effect measurements show that the electron mobility of the alloy with smallest band gap (E_g~0.1 eV) grown directly on GaAs is found to $1.5\times10^3 cm^2/Vs$ whereas it is increased to $1.3\times10^4 cm^2/Vs$ by the growth of InSb and InAsSb step composition buffer layers. The observed mobility value is comparable to that of the alloy grown by molecular beam epitaxy. The enhanced mobility value is due to the improvement in the structural quality of the alloy. It is also observed that the step growth buffer layer is further improving the crystallinity and homogeneity of the epilayer due to strain compensation between the buffer layer and the substrate.

Besides, p-type InSb epilayers are grown by Zn doping and InSb/InAsSb structures are fabricated by HWE.