



DEVICES WITH GROUP IV ELEMENT-DOPED GROUP III-V COMPOUND SEMICONDUCTORS

Abstract

This invention embodies devices comprising Group III-V compound
5 semiconductors in which p or n or both p and n regions are formed by a superlattice
(13, 14) selectively doped with an amphoteric Group IV element dopant (23)
selected from carbon, germanium and silicon. The superlattice includes a plurality
of periods (20), each including two layers (21, 22). Depending on the conductivity
10 type, only one of the layers in the periods forming the superlattice region of said type
of conductivity is selectively doped with said dopant, leaving the other layer in these
periods undoped. The superlattice is formed by Molecular Beam Epitaxy technique,
and the dopant is incorporated into respective layers by delta-doping as in a sheet
centrally deposited between monolayers forming the respective layers of the period.
Each period includes 5 to 15 monolayers deposited in the two layers in a numerical
15 ratio corresponding to a cation compositional ratio in the compound semiconductor.
Low growth temperatures, e.g. ranging from 410 to 450°C lead to mirror-like
surfaces. For a compound semiconductor $\text{Ga}_{0.47}\text{In}_{0.53}\text{As}$, the GaAs/InAs ordered
superlattices with eight monolayers per period are grown in a ratio of 0.47/0.53. At
free carrier concentrations of 10^{16}cm^{-3} , carrier mobilities of 200 and $2300\text{ cm}^2/\text{Vs}$
20 for p-type and n-type are obtained with carbon as the amphoteric dopant.