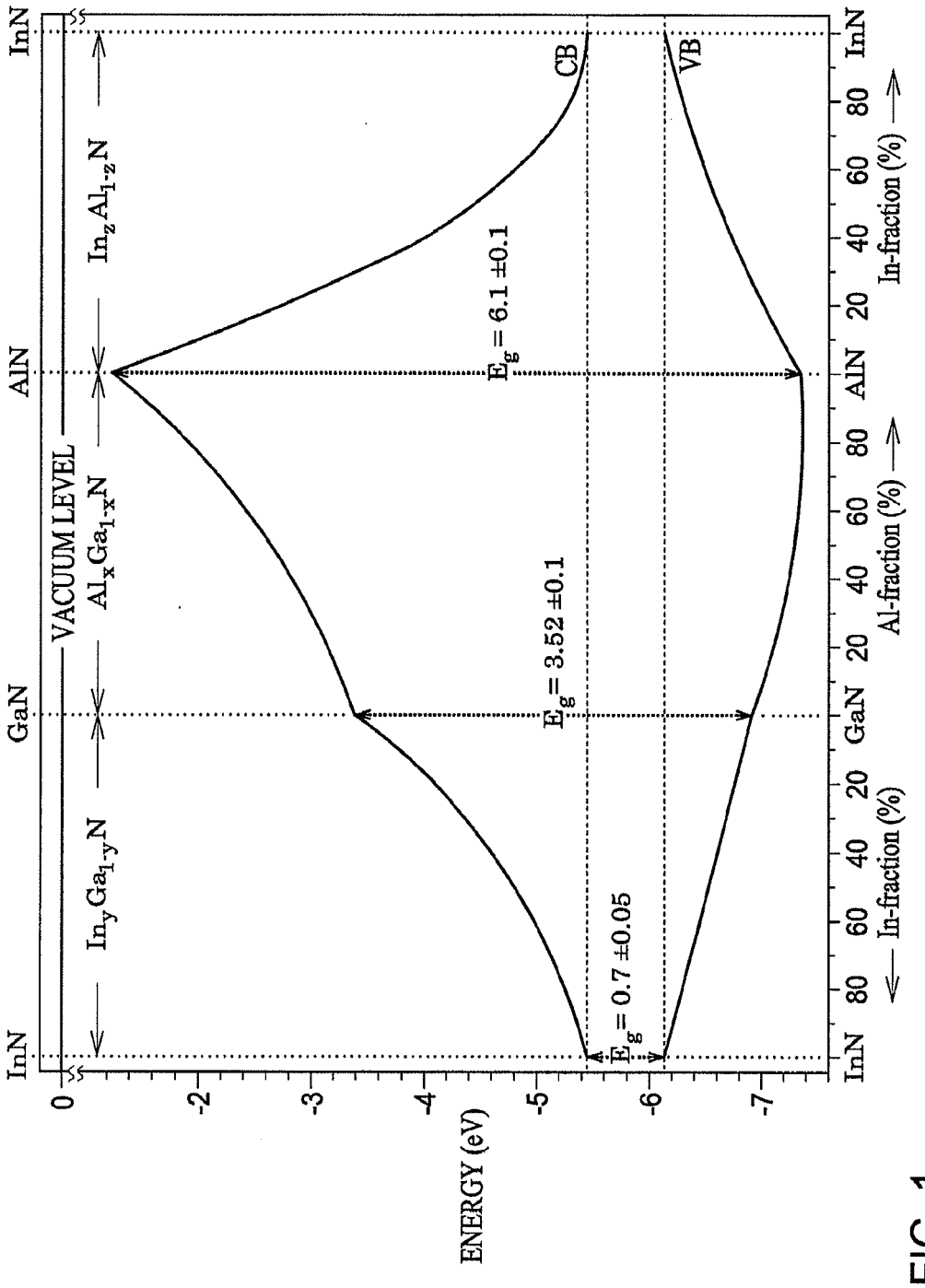

InN
GaN
AlN
InN
VACUUM LEVEL
$In_yGa_{1-y}N$
$Al_xGa_{1-x}N$
$In_zAl_{1-z}N$
CB
VB
$E_g = 6.1 \pm 0.1$
$E_g = 3.52 \pm 0.1$
$E_g = 0.7 \pm 0.05$
ENERGY (eV)
0
-2
-3
-4
-5
-6
-7
InN 80 60 40 20 GaN
In-fraction (%)
GaN 20 40 60 80 AlN
Al-fraction (%)
AlN 20 40 60 80 InN
In-fraction (%)

FIG. 1

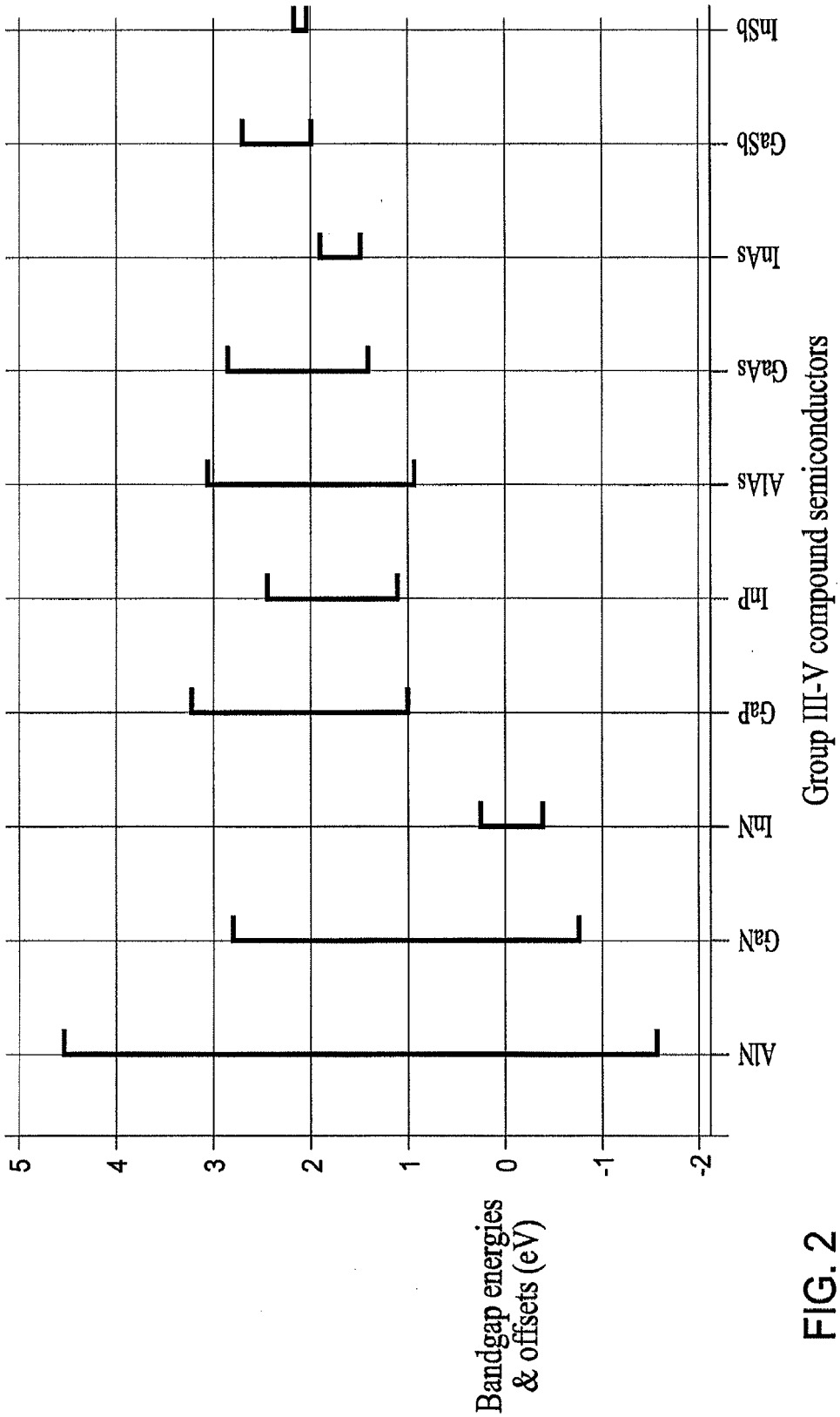

Bandgap energies & offsets (eV)
5
4
3
2
1
0
-1
-2
AlN
GaN
InN
GaP
InP
AlAs
GaAs
InAs
GaSb
InSb
Group III-V compound semiconductors

FIG. 2

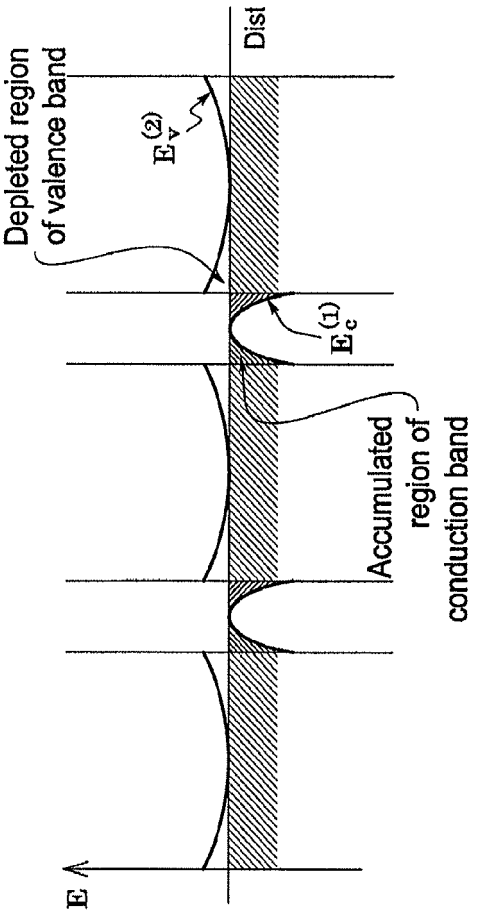


FIG. 3B
E-distance band profile diagram of incoherent type-II structures with periodic inserted 2DILs

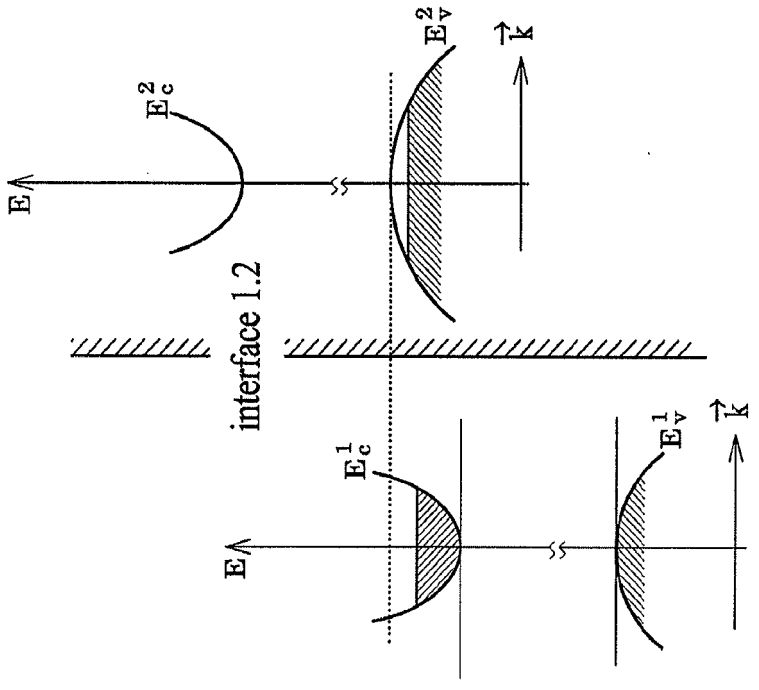
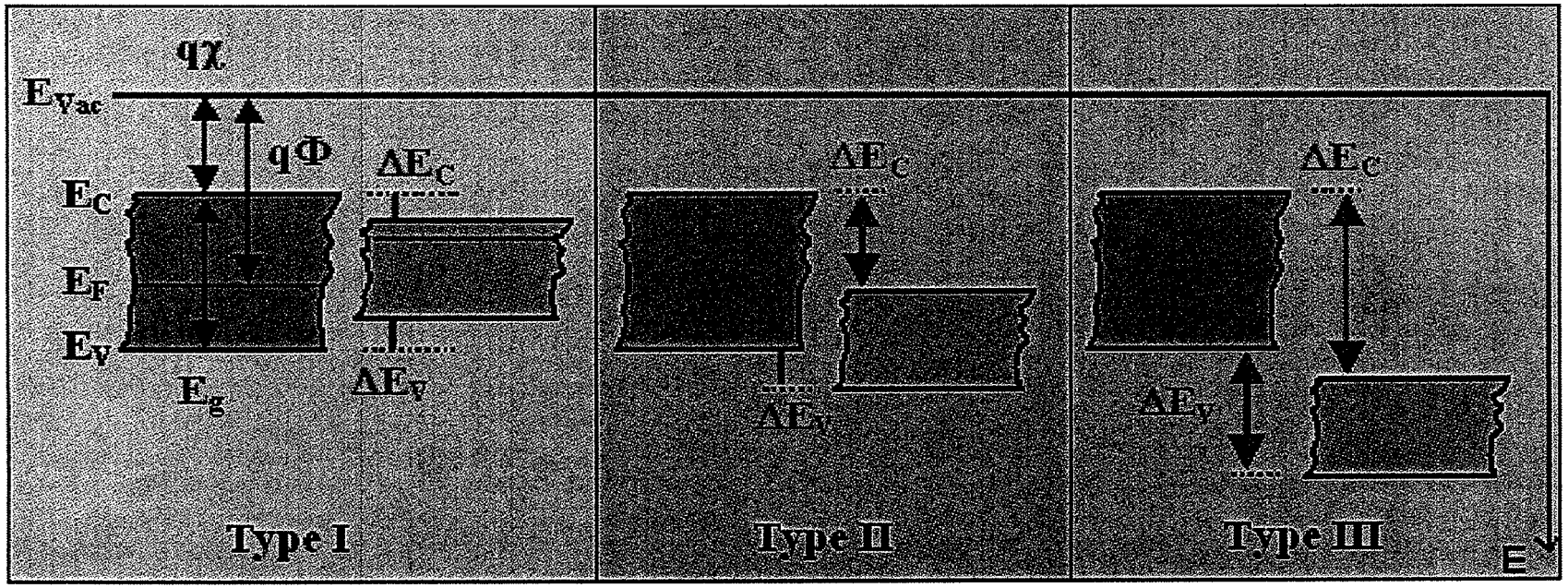


FIG. 3A
E-k dispersion diagram band of an incoherent type-II super lattice structure

Types of band alignments in heterostructures



Type I: (straddling)
The bandgap of one semiconductor is completely contained in the bandgap of the other one

i.e. $E_C(2) > E_V(1)$ and $E_V(2) < E_V(1)$.
The discontinuities of the bands are such that both types of carriers, electrons and holes, need energy (ΔE_C and ΔE_V) to change from the material with the smaller band gap to the one with the larger gap - the carriers from the other side gain this energy.

...for instance
GaAs/AlGaAs or GaN/GaInN

Type II: (staggered)
The bandgaps overlap, but one $\Delta E_{C,V}$ changes sign. The situation with respect to moving carriers from (1) to (2) or vice verse is no longer symmetrical. One kind of carrier gains energy (in the example if electrons move from right to left), the other one needs energy (the holes).
...for instance: InP/InSb

Type III (broken-gap):
The bandgaps do not overlap at all. The situation for carrier transfer is like type II, just more pronounced.
...for instance
GaSb/InAs
InGaN/InGaP
InGaN/C ...etc.

E_C = energy of conduction band
E_v = energy of valance band
E_G = Band gap energy = $(E_C - E_v)$
E_F = Fermi energy
(energy of the highest occupied quantum state..
...shifts with doping/impurities,etc.)
χ = electron affinity
Φ = workfunction

FIG. 4

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