TABLE 1 OPTOELECTRONIC PARAMETERS FOR CONFIGURATION 1

Parameter	$GaInP_2$	GaAs	Ge
Bandgap (E_g)	1.9 eV	1.42 eV	0.67 eV
Wavelength (λ)	0.65428e-06 m	0.875e-06 m	1.775e-06 m
No of equivalent minima in the conduction band (M_c)	1	1	1
No of equivalent minima in the valence band (M_v)	3	1	1
Electron Mobility (μ_e)	0.4 (m^2/Vs)	0.2322 (m^2/Vs)	0.39 (m^2/Vs)
Hole mobility (μ_h)	0.02 (m^2/Vs)	0.02 (m^2/Vs)	0.19 (m^2/Vs)
m_e^*/m_e	0.155	0.067	1.64
m_h^*/m_h	0.460	0.473	0.28
Shockley-Read-**Hall lifetime (T_{SRH})**	10^{-5} (s)	10^{-5} (s)	10^{-5} (s)
Direct band-band recombination coefficient (B)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)
Acceptor concentration (N_A)	1e23 (m^{-3})	9e23 (m^{-3})	1e23 (m^{-3})
Donor concentration (N_D)	2e24 (m^{-3})	7.8e23 (m^{-3})	2e24 (m^{-3})
Thickness of p- layer (X_p)	100e-09 m	100e-09 m	100e-09 m
Thickness of n- layer (X_n)	208e-09 m	300e-09 m	400e-09 m
Lattice constant	5.660e-10 m	5.659e-10 m	5.646e-10 m

TABLE 2 RESULTS FOR DIFFERENT LAYERS FOR CONFIGURATION 1

Parameter	Values
Top layer $GaInP_2$ (E_g= 1.9 eV)	
Short circuit current density (J_{sc1})	744.89 (A/m^2)
Open circuit voltage (V_{oc1})	1.43 V
Middle layer GaAs (E_g=1.42 eV)	
Short circuit current density (J_{sc2})	652.39 (A/m^2)
Open circuit voltage (V_{oc2})	1.0415 V
Bottom layer Ge (E_g= 0.67 eV)	
Short circuit current density (J_{sc3})	163.9747 (A/m^2)
Open circuit voltage (V_{oc3})	0.1216 V

TABLE 3TOTAL CELL PARAMETERS FOR CONFIGURATION 1 FOR 1 SUN CONCENTRATION

Parameters	Value
Current Density, J_{sc}	163.9747 (A/m^2)
Total open circuit voltage, V_{oc}	2.5991 V
Maximum Voltage (V_m)	2.4802 V
Maximum Current Density	162.2754 (A/m^2)
Fill factor	0.9444
Efficiency, η	40.2 %

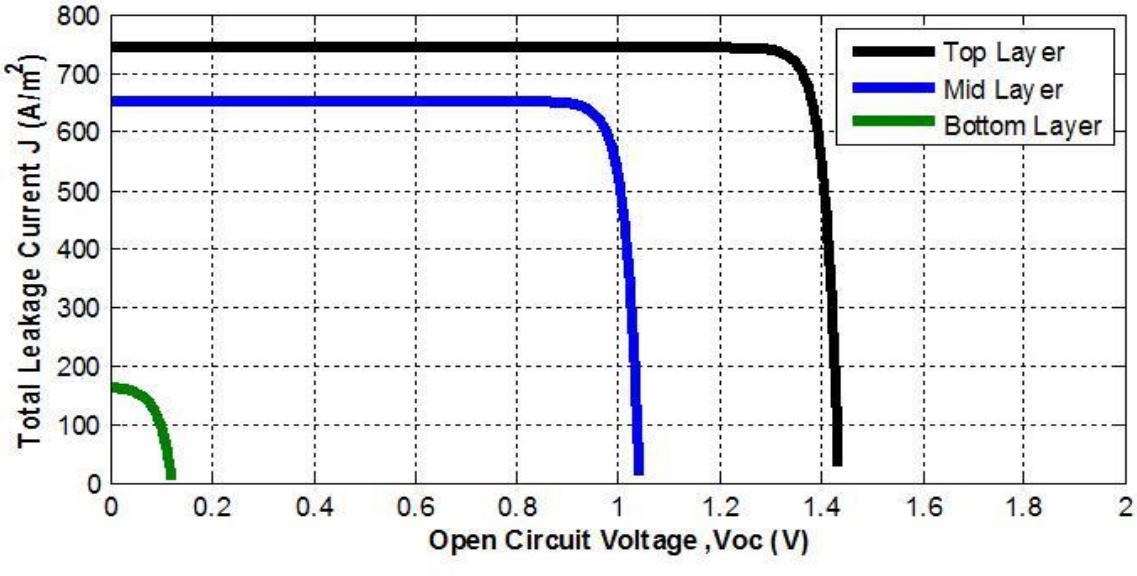

figure : J-V characteristics curve for configuration 1 for 1 sun concentration

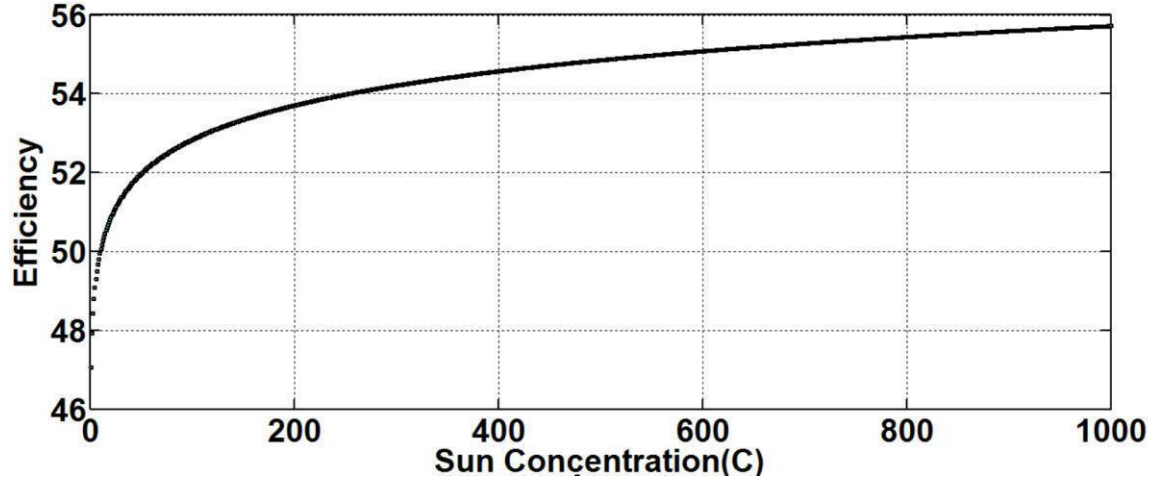

figure : Efficiency Vs sun concentration for configuration 1

TABLE 4 OPTOELECTRONIC PARAMETERS FOR CONFIGURATION 2

Parameter	**$GaInP_2$**	**GaAs**	**$GaAs_{0.91}Bi_{0.085}$**
Bandgap (E_g)	1.9 eV	1.42 eV	0.7 eV
Wavelength (λ)	0.65428e-06 m	0.875e-06 m	1.775e-06 m

No of equivalent minima in the conduction band (M_c)	1	1	1
No of equivalent minima in the valence band (M_v)	3	1	1
Electron Mobility (μ_e)	0.4 (m^2/Vs)	0.2322 (m^2/Vs)	0.12 (m^2/Vs)
Hole mobility (μ_h)	0.02 (m^2/Vs)	0.02 (m^2/Vs)	0.0019 (m^2/Vs)
m_e^*/m_e	0.155	0.067	1.64
m_h^*/m_h	0.460	0.473	0.044
Shockley-Read-Hall lifetime **(T_{SRH})**	10^{-5} (s)	10^{-5} (s)	10^{-5} (s)
Direct band-band recombination coefficient (B)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)
Acceptor concentration (N_A)	1e23 (m^{-3})	9e23 (m^{-3})	2e24(m^{-3})
Donor concentration (N_D)	2e24 (m^{-3})	7.8e23 (m^{-3})	4.4e25(m^{-3})
Thickness of p- layer (X_p)	100e-09 m	100e-09 m	500e-09 m
Thickness of n- layer (X_n)	208e-09 m	300e-09 m	100e-09 m
Lattice constant	5.660e-10 m	5.659e-10 m	5.655e-10 m

TABLE 5RESULTS FOR DIFFERENT LAYERS FOR CONFIGURATION 2

Parameter	**Values**
Top layer $GaInP_2$ (E_g= 1.9 eV)	
Short circuit current density (J_{sc1})	744.8989 (A/m^2)

Open circuit voltage (V_{oc1})	1.4360 V
Middle layer GaAs (E_g=1.42 eV)	
Short circuit current density (J_{sc2})	652.3479 (A/m^2)
Open circuit voltage (V_{oc2})	1.0415V
Bottom layer $GaAs_{0.91}Bi_{0.085}$ (E_g= 0.7 eV)	
Short circuit current density (J_{sc3})	163.9175 (A/m^2)
Open circuit voltage (V_{oc3})	0.2794V

TABLE 6 TOTAL CELL PARAMETER FOR CONFIGURATION 2 FOR SUN CONENTRATION 1

Parameters	**Value**
Current Density, J_{sc}	163.9747 (A/m^2)
Total open circuit voltage, V_{oc}	2.7569 V
Maximum Voltage (V_m)	2.6365 V
Maximum Current Density	162.3761 (A/m^2)
Fill factor	0.9470
Efficiency, η	42.8 %

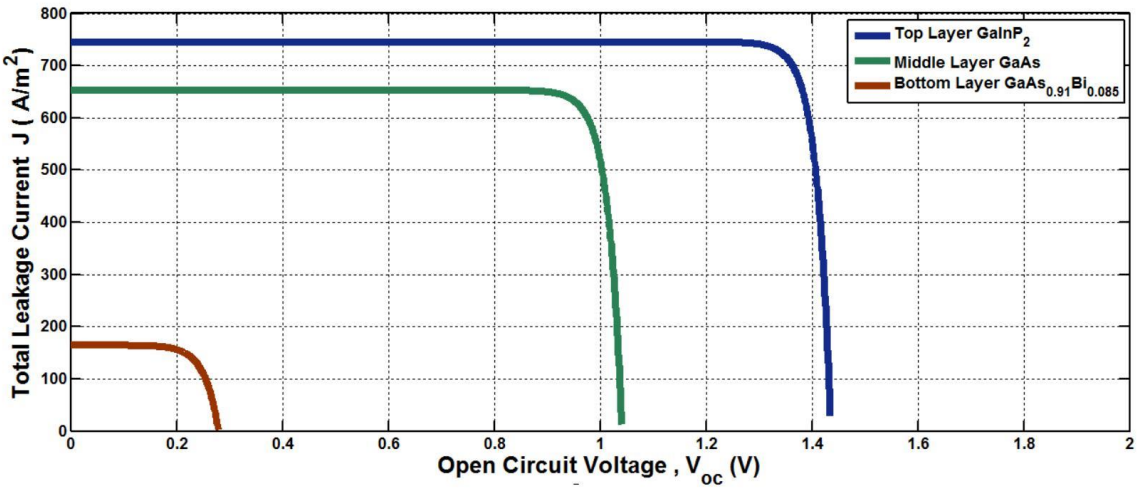

figure : J-V characteristics curve for configuration 2 for 1sun concentration

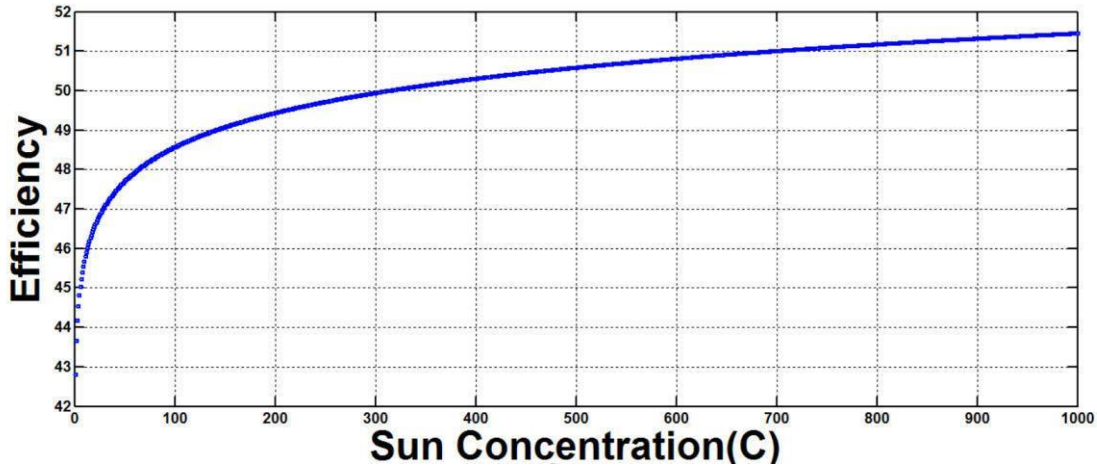

figure : Efficiency Vs sun concentration curve for configuration 2

TABLE 7 OPTOELECTRONIC PARAMETERS FOR CONFIGURATION 3

Parameter	**AlAs**	**GaAs**	**$GaAs_{0.91}Bi_{0.085}$**
Bandgap (E_g)	2.17 eV	1.42 eV	0.7 eV
Wavelength (λ)	0.5730e-06 m	0.875e-06 m	1.775e-06 m
No of equivalent minima in the conduction band (M_C)	1	1	1
No of equivalent minima in the valence band (M_V)	1	1	1

Electron Mobility (μ_e)	0.02 (m^2/Vs)	0.2322 (m^2/Vs)	0.12 (m^2/Vs)
Hole mobility (μ_h)	0.01 (m^2/Vs)	0.02 (m^2/Vs)	0.0019 (m^2/Vs)
m_e^*/m_e	0.146	0.067	1.64
m_h^*/m_h	0.760	0.473	0.044
Shockley-Read-**Hall lifetime (T_{SRH})**	10^{-5} (s)	10^{-5} (s)	10^{-5} (s)
Direct band-band recombination coefficient (B)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)	7.5e-16 (s^1m^3)
Acceptor concentration (N_A)	1.7e24 (m^{-3})	9e23 (m^{-3})	2e24(m^{-3})
Donor concentration (N_D)	1.5e24 (m^{-3})	7.8e23 (m^{-3})	4.4e25(m^{-3})
Thickness of p- layer (X_p)	100e-09 m	100e-09 m	500e-09 m
Thickness of n- layer (X_n)	208e-09 m	300e-09 m	100e-09 m
Lattice constant	5.633e-10 m	5.659e-10 m	5.655e-10 m

TABLE 8 RESULTS FOR DIFFERENT LAYERS FOR CONFIGURATION 3

Parameter	Values
Top layer AlAs(E_g= 2.17 eV)	
Short circuit current density (J_{sc1})	700.5292 (A/m^2)
Open circuit voltage (V_{oc1})	1.6997V
Middle layer GaAs (E_g=1.42 eV)	
Short circuit current density (J_{sc2})	652.3479 (A/m^2)
Open circuit voltage (V_{oc2})	1.0415V
Bottom layer $GaAs_{0.91}Bi_{0.085}$ (E_g= 0.7 eV)	
Short circuit current density (J_{sc3})	163.9175 (A/m^2)
Open circuit voltage (V_{oc3})	0.2794V