TABLE 5.2-2 Energy Gaps of the Binary III–V Compounds

Compound	Type of energy gap	Experimental energy gap, E_g (eV) 0°K	Ref.	300°K	Ref.	Temperature dependence of energy gap, $E_g(T)$ (eV)
AlP	indirect	2.52	*a*	2.45	*a*	$2.52-3.18\times10^{-4}T^2/(T+588)$[r]
AlAs	indirect	2.239	*b*	2.163	*b*	$2.239-6.0\times10^{-4}T^2/(T+408)$[r]
AlSb	indirect	1.687	*c*	1.58	*d*	$1.687-4.97\times10^{-4}T^2/(T+213)$
GaP	indirect	2.338	*e*	2.261	*e*	$2.338-5.771\times10^{-4}T^2/(T+372)$
GaAs	direct	1.519	*f*	1.424	*g*	$1.519-5.405\times10^{-4}T^2/(T+204)$
GaSb	direct	0.810	*h*	0.726	*i*	$0.810-3.78\times10^{-4}T^2/(T+94)$[r]
InP	direct	1.421	*j*	1.351	*j*	$1.421-3.63\times10^{-4}T^2/(T+162)$[r]
InAs	direct	0.420	*k*	0.360	*l*	$0.420-2.50\times10^{-4}T^2/(T+75)$[r]
InSb	direct	0.236	*m*	0.172	*i*	$0.236-2.99\times10^{-4}T^2/(T+140)$[r]

TABLE 5.2-3 Selected Properties of III–V Binary Compounds

Compound	Electron affinity χ(eV)	Ref.	Conduction band effective mass m_n	Ref.	Valence band effective mass m_p	Ref.	Dielectric constant ε	Ref.	Refractive index at E_g, n	Ref.	Thermal conductivity σ (W/cm-deg)	Ref.
AlP	—	—	—	—	$0.70m_0$	*f*	—	—	3.027	*y*	0.9	*ff*
AlAs	—	—	$0.15m_0$	*g*	$0.79m_0$	*f*	$10.1\varepsilon_0$	*q*	3.178	*q*	0.91	*gg*
AlSb	3.64	*a*	$0.12m_0$	*h*	$0.98m_0$	*f*	$14.4\varepsilon_0$	*r*	>3.4	*z*	0.57	*ff*
GaP	4.0[est]	*b*	$0.82m_0$	*i*	$0.60m_0$	*j*	$11.1\varepsilon_0$	*s*	3.452	*aa*	0.77	*ff*
GaAs	4.05	*c*	$0.067m_0$	*k*	$0.48m_0$	*k*	$13.1\varepsilon_0$	*t*	3.655	*bb*	0.44	*ff*
GaSb	4.03	*c*	$0.042m_0$	*h*	$0.44m_0$	*l*	$15.7\varepsilon_0$	*u*	3.82	*cc*	0.33	*ff*
InP	4.4	*d*	$0.077m_0$	*m*	$0.64m_0$	*n*	$12.4\varepsilon_0$	*v*	3.450	*dd*	0.68	*ff*
InAs	4.54	*e*	$0.023m_0$	*m*	$0.40m_0$	*o*	$14.6\varepsilon_0$	*w*	~3.52	*w*	0.27	*ff*
InSb	4.59	*c*	$0.0145m_0$	*p*	$0.40m_0$	*p*	$17.7\varepsilon_0$	*x*	~4.0	*ee*	0.17	*ff*

Table 1. Material parameters for various zincblende-type semiconductors. Lattice constant a (in Å) at room temperature and elastic constants c_{11}, c_{12} and c_{44} (in 10^{12} dyn cm^{-2}; [15]). Valence-band average $E_{v,av}$ and hydrostatic deformation potentials a_v and $a_c(\Gamma)$ as calculated within Van de Walle's model-solid approach (in eV; [5]). Spin-orbit splittings Δ_0, band gaps $E_g(\Gamma)$, $E_g(X)$, $E_g(L)$ (at room temperature) and shear deformation potentials b and d (in eV; [15] and [22], except where indicated).

	a	c_{11}	c_{12}	c_{44}	$E_{v,av}$	Δ_0	$E_g(\Gamma)$	$E_g(X)$	$E_g(L)$	a_v	$a_c(\Gamma)$	b	d
AlP	5.451	1.32	0.63	0.62	−8.09	0.07[a]	3.58	2.45	3.11[a]	3.15	−5.54	−1.6[a]	
AlAs	5.660	1.25	0.53	0.54	−7.49	0.28	2.95	2.16[b]	2.80[a]	2.47	−5.64	−1.5[a]	
AlSb	6.136	0.88	0.43	0.41	−6.66	0.65	2.22	1.61[c]	2.21[c]	1.38	−6.97	−1.4	−4.3
GaP	5.451	1.41	0.62	0.70	−7.40	0.08	2.74	2.26	2.63	1.70	−7.14	−1.5	−4.6
GaAs	5.653	1.18	0.54	0.59	−6.92	0.34	1.42	1.91[b]	1.73[b]	1.16	−7.17	−1.7	−4.6
GaSb	6.096	0.88	0.40	0.43	−6.25	0.82	0.72	1.05[c]	0.76[c]	0.79	−6.85	−2.0	−4.8
InP	5.869	1.02	0.58	0.46	−7.04	0.11	1.35	2.21[d]	2.05[d]	1.27	−5.04	−1.6	−4.2
InAs	6.058	0.83	0.45	0.40	−6.67	0.38	0.36	1.37[d]	1.07[d]	1.00	−5.08	−1.8	−3.6
InSb	6.479	0.66	0.36	0.30	−6.09	0.81	0.17	1.63[d]	0.93[d]	0.36	−6.17	−2.1	−5.0

[a] Present work [16].
[b] [17].
[c] [21].
[d] [10].

Table 2. Band gap (at Γ) and spin–orbit splitting bowing parameters.

	$C(E_g)$	$C(\Delta_0)$	Reference
$AlAs_xSb_{1-x}$	0.84	0.15	[18]
$Al_xGa_{1-x}P$	0.0	0.0	[20]
$Al_xGa_{1-x}As$	0.37	0.0	[17, 27]
$Al_xGa_{1-x}Sb$	0.47	0.30	[21]
$Al_xIn_{1-x}P$	0.0	0.0	[22, 18]
$Al_xIn_{1-x}As$	0.70	0.15	[22, 18]
GaP_xAs_{1-x}	0.21	0.0	[22]
$GaAs_xSb_{1-x}$	1.2	0.60	[22, 18]
$Ga_xIn_{1-x}P$	0.79	0.0	[22, 28]
$Ga_xIn_{1-x}As$	0.38	0.15	[23, 29]
$Ga_xIn_{1-x}Sb$	0.42	0.0	[22]
InP_xAs_{1-x}	0.28	0.10	[24, 18]
InP_xSb_{1-x}	1.3	0.75	[25, 18]
$InAs_xSb_{1-x}$	0.58	1.2	[22, 29]