**substance: $PtSb_2$**
**property: electronic properties**

The valence band maxima are six ellipsoids on [100] axes, with $K = m_{\parallel}/m_{\perp} = 0.87$ (low $T$)...0.67 (high $T$). The eight conduction band minima lie on [111] axes, with $m_{\parallel}/m_{\perp} = 1.43$ (low $T$)...1.36 (high $T$). Both the valence and conduction bands are derived from Pt d-orbitals with an additional higher-energy s-like conduction band [65E, 72D, 83D].

**energy gaps**

| | | | | |
|---|---|---|---|---|
| $E_{g,th}$ | ≥ 0.05 eV | | from $\log \rho \propto E_g/2kT$<br>polycrystalline sample | 63H |
| | 0.06 eV | | from $\rho(T)$ and $R_H(T)$,<br>single crystal and polycrystal | 65J |
| | 0.075 eV | $T$ = 0 K | from $\log \rho \approx 0.4\, E_g/kT$,<br>assuming $(\mu_n+\mu_p)(p\cdot n)^{1/2}$<br>temperature independent | 65D |
| | 0.11 eV | | from resistivity, Hall effect<br>and Nernst-Ettingshausen effect<br>on single crystals | 73A |
| | 0.112 eV | | from $\log \rho \propto E_g/2kT$ in the intrinsic<br>region, $T$ = 120...300 K,<br>single crystals | 68E |
| | (0.110 – 0.00015$T$) eV | | from resistivity and Hall effect on<br>Te doped single crystals;<br>ac method,<br>100Hz, frequency independent<br>50...$10^4$ Hz, $T$ in K | 83D |
| $E_{g,ind}$ | ≈ 0.10 eV | | indirect gap from optical<br>absorption | 65D,<br>68R,<br>70O,<br>72D |
| | 0.104...0.113 eV | $T$ = 10 K | band-to-band indirect absorption<br>threshold | 68R,<br>70O |
| $E_{g,dir}$ | > 0.4 eV | $T$ = 4 K | from the energy dependence of the<br>cyclotron mass<br>$m_{\omega_c}(E) = m_{\omega_c}(0)/(1+(2E/E_{g,dir}))$;<br>$m_{\omega_c}$ changes by less than 5%<br>when $E$ increases by 0.11 eV | 72D |

**donor levels**

| | | | |
|---|---|---|---|
| $E_d$ | 2.3 eV | ionization energy of an isolated<br>donor (Te doped sample) | 76A |
| | 3...4 eV | from $\rho(T)$ of Te-doped samples | 68R |
| | 3...5.5 eV | | 83D |

**effective masses**

$m_{n,p} = n_{C,V}^{2/3}(m_1 m_2 m_3)^{1/3} = n_{C,V}^{2/3} m_{\|}^{1/3} m_{\perp}^{2/3} = n_{C,V}^{2/3}(m_N)_{C,V}$; $n_C$, $n_V$ are the numbers of ellipsoids in conduction and valence band, respectively

| | | | | |
|---|---|---|---|---|
| $m_{n\|}$ | 0.53...0.66 $m_0$ | low $T$...high $T$ | calculated from theoretical band model based on experimental data from [65D] | 65E |
| $m_{n\perp}$ | 0.37...0.49 $m_0$ | low $T$...high $T$ | | |
| $(m_N)_C$ | 0.42...0.54 $m_0$ | low $T$...high $T$ | density of states effective mass | 65E |
| | 0.5 $m_0$ | low $T$ | | 65D |
| $m_n{}^c$ | 1.6 $m_0$ | $T$ = 360 K | conductivity effective mass of a single ellipsoid $3(m_1^{-1}+m_2^{-1}+m_3^{-1})^{-1}$ derived from the edge of the plasma reflection | 73A |
| | 0.35 $m_0$ | $T$ = 50...100 K | conductivity effective mass for a single valley in the conduction band | 83D |
| | 0.34...0.57 $m_0$ | $T$ = 77 K | conductivity effective mass, from optical absorption, assuming acoustic-phonon scattering or ionized-impurity scattering (upper limit) | 68R |
| $m_{p\|}$ | 0.52...0.55 $m_0$ | low $T$...high $T$ | based on theoretical band model and data from [65D] | 65E |
| | 0.35 $m_0$ | $T$ = 77 K | using the theoretical model of [65E] with $m_{\|}/m_{\perp}$ = 0.77 | 73A |
| | 0.66 $m_0$ | $T$ = 310 K | | |
| $m_{p\perp}$ | 0.60...0.82 $m_0$ | low $T$...high $T$ | | 65E |
| | 0.45 $m_0$ | $T$ = 77 K | | 73A |
| | 0.85 $m_0$ | $T$ = 310 K | | |
| $(m_N)_V$ | 0.57...0.72 $m_0$ | low $T$...high $T$ | density of states mass of a single ellipsoid | 65E |
| | 0.22 $m_0$ | $T$ = 4 K | | 65D, 72D |
| | 0.41 $m_0$ | $T$ = 77 K | from $S(T)$ assuming acoustic-phonon scattering only ($m_p$ = 1.34 $m_0$) | 73A |
| | 0.17...0.30 $m_0$ | $T$ = 77 K | conductivity effective mass, from | 68R |
| | 0.2 $m_0$ | $T$ = 300 K | optical absorption from plasma reflection | 83D |
| | 1.0 $m_0$ | $T$ = 360 K | conductivity effective mass from the edge of the plasma reflection | 73A |
| | 0.168 $m_0$ | $T$ = 1.3...4.4 K<br>$B$ < 6 T | least cyclotron mass $(m_1 m_2)^{1/2}$ from high-field magnetoresistance on p-type single crystals | 72D |

anisotropy of valence band principal effective masses: $m_1$:$m_2$:$m_3$ = 0.61:1:1.64 (= 0.134:0.22:0.361) from Shubnikov-de Haas oscillations [72D]. Group-theoretical arguments, however, require that in space group Pa3 of the pyrite structure the [1 0 0] ellipsoids should have two equal principal masses [83D].

For the temperature dependence of the density-of-states mass, see Fig. 1.

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**Fig. 1.**

$PtSb_2$. Density of states effective masses of electrons and holes vs. temperature in a doubly-logarithmic scale [73A].