

## Semiconductor Detector Materials

Properties of materials used for room temperature semiconductor detectors

Material	Cd <sub>0.9</sub> Zn <sub>0.1</sub> Te	CdTe	Ge	Si	GaAs	Hgl <sub>2</sub>	Pbl <sub>2</sub>	a-Si	a-Se
Atomic numbers	48, 30, 52	48, 52	32	14	31, 33	80, 53	82, 53	14	34
Average atomic number	49.1	50	32	32	32	62	62.7	14	34
Density $\rho$ (g/cm <sup>3</sup> )	5.78	5.85	5.33	2.33	5.32	6.4	6.2	2.3	4.3
Band gap $E_g$ (eV)	1.572	1.5	0.67	1.12	1.43	2.13	2.32	1.8	2.2
Dielectric Constant	10.9	11	16	11.7	12.8	8.8		11.7	6.6
Pair creation energy $E_{pair}$ (eV)	4.64	4.43	2.95	3.62	4.2	4.2	4.9	4	7
Resistivity $\rho$ ( $\Omega$ cm)	$3 \times 10^{10}$	$10^9$	50	$< 10^4$	$10^7$	$10^{13}$	$10^{12}$	$10^{12}$	$10^{12}$
Electron mobility $\mu_e$ (cm <sup>2</sup> /Vs)	1000	1100	3900	1400	8000	100	8	1	0.005
Electron lifetime $\tau_e$ (s)	$3 \times 10^{-6}$	$3 \times 10^{-6}$	$> 10^{-3}$	$> 10^{-3}$	$10^{-8}$	$10^{-6}$	$10^{-6}$	$6.8 \times 10^{-9}$	$10^{-6}$
Hole mobility $\mu_h$ (cm <sup>2</sup> /Vs)	50 – 80	100	1900	480	400	4	2	0.005	0.14
Hole lifetime $\tau_h$ (s)	$10^{-6}$	$2 \times 10^{-6}$	$10^{-3}$	$2 \times 10^{-3}$	$10^{-7}$	$10^{-5}$		$4 \times 10^{-6}$	$10^{-6}$
$(\mu\tau)_e$ (cm <sup>2</sup> /V)	$(3-5) \times 10^{-3}$	$3.3 \times 10^{-3}$	$> 1$	$> 1$	$8 \times 10^{-5}$	$10^{-4}$	$8 \times 10^{-6}$	$6.8 \times 10^{-8}$	$5 \times 10^{-9}$
$(\mu\tau)_h$ (cm <sup>2</sup> /V)	$5 \times 10^{-5}$	$2 \times 10^{-4}$	$> 1$	$\approx 1$	$4 \times 10^{-6}$	$4 \times 10^{-5}$		$2 \times 10^{-8}$	$1.4 \times 10^{-7}$