APPENDIX 8

Electrical Conductivity of Selected Materials

Resistivities and conductivities are the numerical inverses of one another, unless both are listed, indicating two separate sources for the information. Both are highly temperature sensitive. Values listed here are nominally at room temperature. Consult Section 6.1 for further information on compositional and temperature dependences.

METALS AND ALLOYS

All elemental metals are commercially pure unless otherwise indicated.

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Silver	6.3×10^7		[1]
Copper	5.85×10^7		[1]
Gold	4.25×10^7		[1]
Aluminum	3.45×10^7		[1]
Al–1.2% Mn alloy	2.95×10^7		[1]
Sodium	2.1×10^7		[1]
Zinc		62.0×10^{-7}	[2]
Zirconium, grade 702		3.97×10^{-7}	[2]
Solder (60Sn–40Pb)		1.50×10^{-7}	[2]
Tin		1.11×10^{-7}	[2]
Lead		2.06×10^{-7}	[2]

(*continued*)

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Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Stainless steel, 301	0.14×10^7		[1]
Nichrome (80% Ni, 20% Cr)	0.093×10^7		[1]
Carbon, graphite	10^5		[1]
Germanium	2.2		[1]
Silicon (intrinsic)	4.3×10^{-4}		[1]
Carbon, diamond (natural)	$<10^{-14}$		[1]
Molybdenum		5.2×10^{-8}	[2]
Tantalum		13.5×10^{-8}	[2]
Tungsten		5.3×10^{-8}	[2]
Platinum		10.60×10^{-8}	[2]
Titanium		4.2×10^{-7}–5.2×10^{-7}	[2]
Titanium alloy Ti–6Al–4 V		17.1×10^{-7}	[2]
Titanium alloy Ti–5Al–2.5Sn		15.7×10^{-7}	[2]
Carbon, diamond (synthetic)		1.5×10^{-2}	[2]
Steel alloy, A36, 1040, 1020		1.6×10^{-7}	[2]
Steel alloy, 4140		2.2×10^{-7}	[2]
Steel alloy, 4340		2.48×10^{-7}	[2]
Stainless steel, 304		7.2×10^{-7}	[2]
Stainless steel, 316		7.4×10^{-7}	[2]
Stainless steel, 405, 440A		6.0×10^{-7}	[2]
Stainless steel, 17-7PH		8.3×10^{-7}	[2]
Iron, gray, G1800		15×10^{-7}	[2]
Iron, gray, G3000		9.5×10^{-7}	[2]
Iron, gray, G4000		8.5×10^{-7}	[2]
Iron, 60-40-18		5.5×10^{-7}	[2]
Iron, 80-55-06, 120-90-02		6.2×10^{-7}	[2]

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Aluminum alloy, 1100		2.9×10^{-8}	[2]
Aluminum alloy, 2024		3.4×10^{-8}	[2]
Aluminum alloy, 6061		3.7×10^{-8}	[2]
Aluminum alloy, 7075		5.22×10^{-8}	[2]
Aluminum alloy, 356.0		4.42×10^{-8}	[2]
Copper alloy, C11000		1.72×10^{-8}	[2]
Copper alloy, C172000 (beryllium–copper)		5.7×10^{-8}–1.15×10^{-7}	[2]
Copper alloy, C26000		6.2×10^{-8}	[2]
Copper alloy, C36000		6.6×10^{-8}	[2]
Copper alloy, C71500 (copper–30% nickel)		37.5×10^{-8}	[2]
Copper alloy, C93200		14.4×10^{-8}	[2]
Magnesium alloy, AZ31B		9.2×10^{-8}	[2]
Magnesium alloy, AZ91D		17×10^{-8}	[2]
Nickel 200		0.95×10^{-7}	[2]
Inconel 625		12.9×10^{-7}	[2]
Monel 400		5.47×10^{-7}	[2]
Invar		8.2×10^{-7}	[2]
Haynes alloy 25		8.9×10^{-7}	[2]
Kovar		4.9×10^{-7}	[2]
Mercury	1.04×10^{6}		[3]

CERAMICS AND GLASSES

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Al_2O_3	10^{-10}–10^{-12}		[1]
$Al_6Si_2O_{13}$ (mullite)		$>10^{12}$	[4]

(*continued*)

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
AlN		2×10^{9}–10^{11}	[4]
B_4C		3×10^{-3}–8×10^{-3}	[4]
BeO	10^{-12}–10^{-15}		[1]
BN		1.7×10^{11}	[4]
CrB_2		21×10^{-8}	[4]
E-glass, fiber		4×10^{14}	[2]
GaAs (intrinsic)		10^{6}	[2]
Glass, soda-lime		10^{10}–10^{11}	[2]
Glass, window	$<10^{-10}$		[1]
Glass, silica	$<10^{-16}$		[1]
Glass-ceramic (Pyroceram)		2×10^{14}	[2]
HfB_2		10^{-7}	[4]
HfC		6×10^{-7}	[4]
InSb	17×10^{3}		[3]
$Mg_2Al_4Si_5O_{18}$ (Cordierite)		10^{12}	[4]
MgO		1.3×10^{13}	[4]
Mica	10^{-11}–10^{-15}		[1]
$MoSi_2$		21.5×10^{-8}	[4]
PbS	38.4		[3]
Si_3N_4		$>10^{12}$	[2]
SiC (highly structurally-dependent)		1.0–10^{10}	[4]
SiO_2, fused		$>10^{18}$	[2]
TaB_2		68×10^{-8}	[4]
TaC		25×10^{-8}	[4]
TiB_2		6.6×10^{-8}–28.4×10^{-8}	[4]
TiC		0.3×10^{-2}–0.8×10^{-2}	[4]

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
TiC	0.17×10^7		[1]
TiN		11×10^{-8}–13×10^{-7}	[4]
TiO_2		$>10^{11}$	[5]
WC		5×10^{-7}	[5]
WSi_2		33.4×10^{-8}–54.9×10^{-8}	[4]
ZrB_2		9.2×10^{-8}	[4]
ZrC		61×10^{-8}–64×10^{-8}	[4]
ZrO_2, 3%Y_2O_3		10^{10}	[2]
ZrO2, monoclinic		$>10^{11}$	[5]

POLYMERS

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Polymethylmethacrylate	$<10^{-12}$		[1]
Polyethylene	$<10^{-14}$		[1]
Polystyrene	$<10^{-14}$		[1]
Polytetrafluoroethylene	$<10^{-16}$		[1]
Phenol-formaldehyde	10^{-7}–10^{-11}		[1]
Polyethylene, low and high density		10^{15}–5×10^{16}	[2]
Polyethylene, ultrahigh molecular weight		$>5 \times 10^{14}$	[2]
Polypropylene		$>10^{14}$	[2]
Rubber, nitrile		3.5×10^8	[2]
Rubber, styrene butadiene		6×10^{11}	[2]
Rubber, silicone		10^{13}	[2]
Epoxy		10^{10}–10^{13}	[2]
Polyamide (Nylon 66)		10^{12}–10^{13}	[2]

(*continued*)

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Polybutylene terephthalate		4×10^{14}	[2]
Polycarbonate		2×10^{14}	[2]
Polyester		10^{13}	[2]
Polyetheretherketone		6×10^{14}	[2]
Polyethylene terephthalate		10^{12}	[2]
Polyvinyl chloride		$>10^{14}$	[2]
Cellulose acetate		$10^{8} - 10^{13}$	[4]
Polyimide		4×10^{13}	[4]
Polyarylsulfone		$3.2 \times 10^{14}–7.71 \times 10^{14}$	[4]

COMPOSITES

Material	Conductivity, mho/m	Resistivity, ohm-m	Source
Wood		$10^{14}–10^{16}$	[2]
Concrete, dry		10^{9}	[2]
Polyimide, glass-fiber-reinforced		9.2×10^{13}	[4]
Nylon, glass-fiber-reinforced		$2.6 \times 10^{13}–5.5 \times 10^{13}$	[4]
Polyester, glass-fiber-reinforced		$3.2 \times 10^{14}–3.3 \times 10^{14}$	[4]
Phenylene oxide, glass-fiber-reinforced		10^{15}	[4]
Polyphenylene sulfide, 40% glass-fiber-reinforced		4.5×10^{12}	[4]
Polystyrene, 30% glass-fiber-reinforced		3.6×10^{14}	[4]
Polyacetal, 20% glass-fiber-reinforced		5×10^{12}	[4]

BIOLOGICS

Material	Conductivity, mho/cm	Resistivity, ohm-m	Source
Cortical bone, dry	10^{-9}		[6]
Cortical bone, wet (10% moisture)	10^{-3}	$3–4 \times 10^3$	[6]
Tissues, soft		5–15	[6]

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