

# List of symbols and abbreviations

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$a$	Slip	$\mathbf{B}_0$	External magnetic field
$\mathbf{a}$	Fundamental lattice translation vector	$\hat{\mathbf{b}}_1, \hat{\mathbf{b}}_2$	Burgers vector
$A$	Area	$B_c$	Magnetic coercive field strength
$\mathcal{A}$	Constant	$B_{c0}$	Critical magnetic field at $T = 0\text{ K}$
$\mathbf{A}$	Prefactor	$B_{c1}, B_{c2}$	Critical magnetic field strength
$\mathbf{a}'$	Primitive lattice vector	bcc	Body-centered cubic
$\mathbf{a}^*$	Reciprocal lattice vector	$B_{\text{crit}}$	Critical magnetic field
$a_0$	(First) Bohr radius	BCS	Bardeen–Cooper–Schrieffer
$A_0$	Cross section	$B_{\text{int}}$	Magnitude of the internal magnetic field
$a_1, a_2, a_3$	Basal lattice translation in the hexagonal lattice	BZ	Brillouin zone
$\mathbf{a}_g$	Acceleration in the electric field	$c$	Speed of light
$b$	Distance	$\mathbf{c}$	Fundamental lattice translation vector
$\mathbf{b}$	Fundamental lattice translation vector	$C$	Constant
$\hat{\mathbf{b}}$	Burgers vector	$\mathcal{C}$	Capacitance
$\mathcal{B}$	Constant	$\mathbf{C}$	Stiffness tensor
$\mathbf{B}$	vector of the magnetic induction	$\mathbf{c}'$	Primitive lattice vector
$\mathbf{b}'$	Primitive lattice vector	$\mathbf{c}^*$	Reciprocal lattice vector
$\mathbf{b}^*$	Reciprocal lattice vector	$c_0$	Starting concentration

$C_1, C_2$	Constant	$E_0$	Minimum energy
CCD	Charge-coupled device	$E_1$	Energy of state 1
$c_e$	heat capacity due to electrons	$E_2$	Energy of state 2
$c_\ell$	Concentration in the liquid	$E_a$	Activation energy
$C_{ijkl}$	Component of the stiffness tensor, $i, j, k, l = x, y, z$	$E_A$	Binding energy of acceptor hole
$c_p$	Heat capacity at constant pressure	$E_b$	Binding energy
$c_{ph}$	Heat capacity due to phonons	$\mathcal{E}_b$	Breakdown field strength
$c_s$	Concentration in the solid	$E_c$	Energy of the conduction band edge
$c_V$	Heat capacity at constant volume	$\mathcal{E}_c$	Coercive field strength
$d$	Distance	$E_D$	Binding energy of donor electron
$\tilde{d}$	Piezoelectric coefficient	$E_F$	Fermi energy
$D$	Density of states	$E_{FA}, E_{FB}$	Fermi energy of metal A, B
$D_0$	Prefactor in the diffusion constant	$E_g$	Band gap
$d_c$	Thickness	$\mathcal{E}_H$	Hall field
$D_e$	Diffusion length of electrons	$E_i$	Ionization energy
$d_i$	Displacement of ions	$E_{kin}$	Kinetic energy
$D_X$	Diffusion constant of the atomic species X	$\mathcal{E}_{loc}$	Local electric field
$d_{hkl}$	Spacing of the lattice planes ( $hkl$ )	$E_{pn}$	Energy of photon number $n$ ( $n = 1, 2, 3, \dots$ )
$d_s$	Slit width	$E_{ph}$	Phonon energy
DOS	Density of states	$E_{pot}$	Potential energy
$e$	Elementary charge	$E_v$	Energy of the valence band edge
$E$	Energy	$f$	Atom scattering factor
$\mathcal{E}$	Electrical field vector	$F$	Degree of freedom
$\hat{\mathcal{E}}$	Amplitude of the electrical field vector	$\mathbf{F}$	Force
$\tilde{E}$	Young's modulus	$\tilde{F}$	Structure amplitude
		FA	Foreign atom

$\mathbf{F}_{\text{attract}}$	Attractive force	$\{hkl\}$	Miller indices of a set of crystallographically identical planes
$\mathbf{F}_C$	Coulomb force		
$F_{\perp}$	Magnitude of the normal force	$h_{\text{max}}$	Maximum height
$F_{\parallel}$	Magnitude of the tangential force	hcp	Hexagonal closed packed
$f_{\text{Cu}}$	Atom scattering factor of copper	HOMO	Highest occupied molecular orbital
FET	Field effect transistor	$i$	Counting index
$f_{\text{Zn}}$	Atom scattering factor of zinc	$I$	Current
$f_j$	Atom scattering factor of atom $j$	$\tilde{I}$	Intensity
fcc	Face-centered cubic	$\vec{i}$	Unit vector in $x$ -direction
$\mathbf{F}_H$	Hall force	$I_0$	Current at time $t = 0$
$\mathbf{F}_L$	Lorentz force	$\tilde{I}_0$	Primary intensity
$\mathbf{F}_r$	Radial force	$\tilde{I}_a$	Absorbed intensity
$\mathbf{F}_{\text{rep}}$	Repulsive force	$I_b$	Current at the base
$g$	Gravitational acceleration	$I_c$	Collector current
$\tilde{G}$	Shear modulus	$I_{\text{diff}}$	Diffusion current
$\mathbf{G}$	Reciprocal lattice vector	$I_{\text{drift}}$	Drift current
$\hat{g}$	Landé splitting factor	$I_e$	Emitter current
$\tilde{g}$	Piezoelectric coefficient	$I_{\text{light}}$	Photocurrent
$\mathbf{G}_0$	Reciprocal lattice vector	$I_{\text{max}}$	Maximum current
GMR	Giant magnetoresistance effect	IR	Infrared
$h, \hbar$	Planck's constant	$I_r$	Current in the diode under reverse bias
$H$	Internal energy	$\tilde{I}_r$	Reflected intensity
$\mathcal{H}$	Magnetic field vector	$\tilde{I}_t$	Transmitted intensity
$h, k, l$	Integer numbers (related to the Miller indices)	$j$	Integer number, counting index
$(hkl)$	Miller indices of a crystallographic plane	$J$	Nucleation rate
		$\hat{J}$	Total angular momentum

$J_e$	Current density	$L_e$	Diffusion length of electrons
$J_{\text{het}}$	Heterogeneous nucleation rate	LED	Light-emitting diode
$\vec{\mathbf{j}}$	Unit vector in $y$ -direction	$L_g$	Grain size
$\mathbf{j}_1, \mathbf{j}_2$	Flux	$L_{\text{tot}}$	Total length
$\mathbf{j}_X$	Flux of atomic species $X$	LUMO	Lowest unoccupied molecular orbital
$k$	Counting index	$m$	Mass
$\mathbf{k}$	Wave vector	$M$	Madelung constant
$K$	Number of components	$\mathbf{M}$	Magnetization
$\mathbf{K}$	Wave vector of lattice vibrations	$m_1, m_2$	Mass
$\tilde{K}$	Bulk modulus	$m_e$	Electron rest mass
$\vec{\mathbf{k}}$	Unit vector in $z$ -direction	$m_e^*$	Effective mass of the electron
$\mathbf{k}_0$	Wave vector of the incident wave	$m_H$	Mass of the hydrogen atom
$\mathbf{k}_1, \mathbf{k}_2, \mathbf{k}_3$	Wave vector	$m_h^*$	Effective mass of the hole
$k_B$	Boltzmann constant	$m_J$	Magnetic moment of the atom
$\mathbf{k}_{\text{max}}$	Maximum wave vector	$m_l$	Orbital magnetic quantum number
$\mathbf{k}'_{\text{max}}$	Maximum wave vector of the diffracted beam	$m_n$	Mass of the $n$ th atom
$\mathbf{k}_{\text{min}}$	Minimum wave vector	$\mathbf{m}_m$	Magnetic dipole moment
$\mathbf{K}_{\text{min}}$	Minimum wave vector of lattice vibrations	MOS	Metal–oxide–semiconductor
$\mathbf{k}'_{\text{min}}$	Minimum wave vector of the diffracted beam	MOSFET	Metal–oxide–semiconductor field effect transistor
$L$	Length	$M_r$	Magnitude of the remanent magnetization
$l$	Orbital quantum number	$m_S$	Schmid factor
$\ell$	Liquid	$M_s$	Magnitude of the saturation magnetization
$\hat{L}$	Total orbital momentum	$m_s$	Spin magnetic quantum number
$l_0, l_1, l_2$	Length	$n$	Counting number; order of diffraction; main quantum number
$l_d$	Dislocation line length		

$N$	Number of atoms in the lattice	$p$	Pressure
$\hat{n}$	Refraction index	$\mathbf{p}$	Momentum
$n_1, n_2, n_3$	Counting number	$P$	Number of Phases
$N_A$	Acceptor density	$\tilde{p}$	Probability
$\mathcal{N}_A$	Avogadro constant	$\mathcal{P}$	Polarization
$n_C$	Number of Cooper pairs	$\mathcal{P}_a$	Dipole moment of one atom
$N_c$	Number of atoms in the corners of the unit cell	$p_h$	Number of holes
		$\mathcal{P}_i$	Ionic polarization
$N_{\text{crit}}$	Number of nuclei with a critical radius	$\mathcal{P}_m$	Polarization of 1 mol
		$\mathcal{P}_r$	Magnitude of the remanent polarization
$N_d$	Number of dislocations		
$N_D$	Donor density	$\mathcal{P}_s$	Magnitude of the saturation polarization
$n_e$	Number of electrons per unit volume	$\mathcal{P}_{\text{tot}}$	Total polarization
$N_e$	Number of atoms at the edges of the unit cell	$q$	Charge
		QHE	Quantum Hall effect
$N_f$	Number of atoms at the faces of the unit cell	$q_i$	Ionic charge
$n_i$	Intrinsic carrier density	$r$	Radius
$N_i$	Number of atoms in the interior of the unit cell	$\mathbf{r}$	Position vector
		$R$	Gas constant
$\hat{n}_i$	Refraction index of the material $i$ , $i = 1, 2$	$\mathbf{R}$	Lattice vector
		$\mathcal{R}$	Resistance
$\langle n_i \rangle$	Average number of phonons in the vibrational state $i$	$\hat{r}$	Constant
$N_{\text{uc}}$	Number of lattice points in the unit cell	$\tilde{R}$	Reflectivity
		$r_-$	Radius of the anion
$N_v$	Number of vacancies in the lattice	$r_+$	Radius of the cation
NC	Normal conductor	$R_\infty$	Rydberg constant
NN	Nearest neighbor	$r_0$	Equilibrium distance

$r_1$	First Bohr radius	$T_0$	Period
$r_a, r_b$	Nonequilibrium distance	$T_1, T_2$	Temperature
$r_f$	Radius of an atom in the fcc structure	$t_1, t_2, t_3$	Time
$R_H$	Hall constant	$T_b$	Boiling temperature
$r_i$	Radius of an atom in an interstitial position	$T_c$	Jump temperature
$\mathbf{r}_j$	Position of atom $j$ with respect to a lattice point	$T_e$	Characteristic temperature of heat capacity of electrons
$r_n$	Radius of the nucleus	TEM	Transmission electron microscopy
$r_n^*$	Critical radius of the nucleus	$T_m$	Melting temperature
RT	Room temperature	$u$	Elongation
$s$	Scaling factor	$\hat{u}$	Maximum elongation
$s$	Solid	$u_n$	Elongation of the $n$ th atom
$\mathbf{s}$	Direction of the energy flow of a wave	$\hat{u}_n$	Maximum elongation of the $n$ th atom
$S$	Entropy	$U$	Voltage
$\tilde{S}$	Structure factor	$U_0$	Threshold voltage
$\hat{S}$	Total spin momentum	$U_s$	Internal energy of a solid
$\mathbf{s}_0$	Direction of the energy flow of the incident wave	$U_d$	Diffusion voltage
sc	Simple cubic	$[uvw]$	Crystallographic direction
SC	Superconductor	$\langle uvw \rangle$	Crystallographic set of crystallographically identical directions
SCR	Space charge region	$\mathbf{v}$	Velocity
SQID	Superconducting quantum interference device	$V$	Volume
$t$	Time	$V_0$	Starting volume
$T$	Absolute temperature	$\mathbf{v}_1, \mathbf{v}_2$	Velocity
$T^*$	Critical nucleation temperature	$\overline{v^2}$	Magnitude of the mean square velocity
		$V_c$	Volume of the unit cell

$\bar{v}_e$	Magnitude of the drift velocity	$\hat{\alpha}$	Linear expansion coefficient
$v_F$	Speed of electrons at the Fermi edge	$\tilde{\alpha}$	Absorption coefficient
$\mathbf{v}_g$	Group velocity	$\tilde{\alpha}_0$	Prefactor in the absorption coefficient
VIS	Visible light	$\tilde{\alpha}_a$	Absorption coefficient due to phonon absorption
$v_l$	Speed of sound of longitudinal waves	$\tilde{\alpha}_e$	Absorption coefficient due to phonon emission
$V_m$	Molar volume	$\alpha_p$	Polarizability
$\mathbf{v}_{\max}$	Maximum velocity	$\beta$	Angle
$V_{nG}$	Fourier coefficient of the lattice potential, $n = 1, 2, 3 \dots$	$\beta_c$	Current gain
$V_R$	Lattice potential	$\gamma$	Angle
$v_s$	Speed of sound	$\hat{\gamma}$	Volume expansion coefficient
$V_s$	Volume of a sphere	$\gamma_0$	Specific surface energy
$v_t$	Thermal speed	$\gamma_s$	Spring constant
$w$	Width	$\Delta E$	Uncertainty in the energy, difference in energy
$w_{\text{scr}}$	Width of the space-charge region	$\Delta E_c$	Change in the position of the conduction band edge
$W_v$	Vacancy formation energy	$\Delta E_v$	Change in the position of the valence band edge
$x$	Coordinate	$\Delta F$	Change in the free energy
$x_j$	Coordinate of atom $j$ with respect to a lattice point	$\Delta G$	Change in the free enthalpy
$y$	Coordinate	$\Delta G_a$	Adsorption energy
$y_j$	Coordinate of atom $j$ with respect to a lattice point	$\Delta G_d$	Diffusion energy in the adsorption layer
$z$	Coordinate	$\Delta G_{\text{het}}^*$	Heterogeneous nucleation energy
$z_0$	Penetration depth	$\Delta G_n^*$	Nucleation work
$z_j$	Coordinate of atom $j$ with respect to a lattice point	$\Delta H$	Melting heat
$\alpha$	Angle		

$\Delta I_b$	Change in the current at the transistor base	$\varepsilon_p$	Plastic strain
$\Delta I_c$	Change in the collector current	$\varepsilon_r$	Dielectric constant
$\Delta \mathbf{k}$	Change in the wave vector	$\varepsilon_t$	True strain
$\Delta l$	Change in the length	$\chi$	Electric susceptibility
$\Delta n_e$	Excess electron density	$\chi_C$	Phase function of Cooper pairs
$\Delta p$	Uncertainty in the momentum	$\chi_m$	Magnetic susceptibility
$\Delta p_h$	Excess hole density	$\kappa$	Distribution coefficient
$\Delta S$	Change in entropy	$\nu$	Frequency
$\Delta S_v$	Gain in entropy by vacancy formation	$\tilde{\nu}$	Poisson's constant
$\Delta t$	Uncertainty in the time	$\nu_0$	Threshold frequency
$\Delta T$	Supercooling	$\lambda$	Wavelength
$\Delta V$	Volume element	$\Lambda$	Thermal conductivity
$\Delta x$	Distance	$\Lambda_e$	Thermal conductivity of electrons
$\Delta y$	Uncertainty in the position	$\bar{\lambda}_{ph}$	Mean free path of phonons
$\Delta \chi_C$	Change in the phase function of Cooper pairs	$\Lambda_{ph}$	Thermal conductivity due to phonons
$\Delta \rho_X$	Change in the density of the atomic species X	$\bar{\lambda}$	Mean free path
$\varepsilon$	Strain	$\tilde{\lambda}$	Lamé coefficient
$\boldsymbol{\varepsilon}$	Strain tensor	$\lambda_{min}$	Minimum wavelength
$\varepsilon_0$	Dielectricity constant of the vacuum	$\lambda_s$	Short wavelength limit
$\varepsilon_B$	Failure strain	$\mu$	Permeability
$\varepsilon_e$	Elastic strain	$\mu_0$	Permeability of the vacuum
$\varepsilon_{ij}$	Component of the strain tensor, $i, j = x, y, z$	$\mu_B$	Bohr magneton
$\varepsilon_{opt}$	Dielectric constant at optical frequencies	$\mu_e$	Mobility of electrons
		$\mu_h$	Mobility of holes
		$\mu_l$	Orbital magnetic moment
		$\mu_s$	Spin magnetic moment



$\Phi$	Workfunction	$\rho_m$	Mass density
$\phi$	Relative nucleation energy	$\rho_X$	Density of the atomic species X
$\Phi_0$	Quantum of the magnetic flux	$\sigma$	Stress
$\Phi_A, \Phi_B$	Workfunction of metal A, B	$\boldsymbol{\sigma}$	Stress tensor
$\Phi_c$	Contact potential	$\Sigma$	Strength-to-weight ratio
$\Phi_m$	Magnetic flux	$\sigma_{0.2\%}$	0.2 % offset yield stress
$\theta$	Angle	$\sigma_1, \sigma_2, \sigma_3$	Normal stress
$\theta_C$	Curie temperature	$\sigma_A$	Anelasticity limit of the stress
$\theta_D$	Debye temperature	$\sigma_B$	Failure stress
$\theta_h$	Hardening coefficient	$\sigma_e$	conductivity
$\Theta$	Incident angle	$\sigma_E$	Elasticity limit of the stress
$\vartheta$	Tilt angle	$\sigma_F$	Fracture stress
$\Theta_B$	Bragg angle	$\sigma_{ij}$	Component of the stress tensor, $i, j = x, y, z$
$\psi$	Wave function	$\sigma_H$	Proportionality limit of the stress
$\Psi$	Angle between the normal of the slip plane and the direction of the external force	$\sigma_K$	Maximum stress at the tip
$\rho$	Dislocation density	$\sigma_{pile}$	Pile-up stress
$\rho_0$	Starting density	$\sigma_S$	Upper yield stress
$\rho_1, \rho_2$	Density	$\sigma'_S$	Lower yield stress
$\rho_d$	Resistivity due to scattering at defects	$\sigma_t$	True stress
$\rho_e$	Resistivity	$\sigma_{theo}$	Theoretical breaking stress
$\rho_f$	Final density	$\tau$	Shear stress
$\rho_l$	Density of the liquid	$\tau_c$	Critical shear stress
$\rho_{ph}$	Resistivity due to phonon scattering	$\tau_d$	Relaxation time of scattering at lattice defects
$\rho_H$	Hall resistivity	$\tau_{max}$	Maximum shear stress
		$\tau_{ph}$	Relaxation time of phonon scattering

$\tau_r$	Relaxation time
$\varphi$	Phase angle
$\omega$	Angular frequency
$\omega_c$	Cyclotron frequency
$\Omega$	Angular frequency of lattice vibrations
$\hat{\Omega}$	Mean angular frequency of lattice vibrations
$\omega_0$	Angular frequency of the incident wave
$\Omega_{ak}$	Angular frequency of acoustical vibrations
$\Omega_D$	Debye frequency
$\Omega_{opt}$	Angular frequency of optical vibrations
$\xi$	Integration variable
$\xi$	Dislocation direction
$\hat{\xi}$	Coherence length