LIST OF SYMBOLS

Accents

$\dot{}$	total derivative with respect to time
$'$	current value in integral
	or general variable whose critical value is to be found
$\hat{}$	maximum value
$\tilde{}$	amplitude

Prefixes

d	total differential
∂	in partial derivative (all other variables held constant)
δ	virtual variation (other hidden variables in equilibrium)
Δ	usually difference between values at stable and unstable equilibrium configuration, for thermal activation

Roman (*and italic*) *letters*		*See eq., Fig., Table*
A	constant in phenomenological relations	34h, 61f
	also: general area, e.g. of surface	21i
a	area swept by dislocation	22-1, 22c, 45-2
a_{BOW}	— bowing between two discrete obstacles	25t
a_{RUN}	— after release in jerky glide	33a
a_{SWEPT}	— after activation event at flow stress	25-11
Δa	activation area	41e, 44c′, q
$\Delta a'$	apparent activation area	43g, h, l″, 44h
B	drag coefficient per unit length of dislocation	31a
b	amount of Burgers vector for full disl.	22c, 27a
b_{P}	— for partial dislocation	27a
$\vec{b}, b_i, b_i^\circ$	Burgers vector, components, unit v.	22b
C	normalized obstacle stiffness	42h, i, 63g
c	concentration (atomic or vol. fraction)	25ee, 25-16, 52l′
c_{ij}	elastic stiffness referred to crystal axes	2-I
c_v	specific heat per atom at const. vol.	31y
D	(diffusion coefficient)	
d	jog height, dipole spacing	26-1, 32x
	also: slip plane spacing	33y, z, cc
	also: activation distance (when $\neq y$)	52n, o

E	effective line tension	25n, o, q, r, 25-8
$\mathcal{E}$	line tension (self force per curvature)	23j, k, 25-8
E_{THERM}	thermal energy density	31t
F	(Helmholtz) free energy	21c, e
ΔF	activation free energy (at given stress)	41-1, 41c
F_o	total free energy to overcome one obstacle	25b, 34o, 41h, 45o, q, 62g
F_{BIND}	binding energy of one solute atom to dislocation	25mm
F_{KINK}	free energy of one kink	51n
F_{NUCL}	free energy to nucleate double kink or bulge	51d′, l
F_{STOR}	free energy stored during deformation	22g
$\mathcal{F}_{\mathrm{DIS}}$	free energy per unit length of dislocation ("line energy")	23g, h′, l, m
$\mathcal{F}_{\mathrm{SCREW}}$, $\mathcal{F}_{\mathrm{EDGE}}$:	line energy of screw, edge	23h, i, 25-8
$\Delta\mathcal{F}_{\mathrm{DIS}}$	— difference between high and low energy position	24-3, 51-1
$\mathcal{F}_{\mathrm{BIND}}$	binding energy per unit length of dislocation	24-2
f	cosine of breaking angle	25v, w′, 52m
G	free enthalpy, Gibbs free energy	41g+
ΔG	activation free enthalpy (also "activation energy")	41-1, 41a, f, g, 43a′, w, 61n
$\Delta\overrightarrow{G}$, $\Delta\overleftarrow{G}$	— for forward and reverse jump	45c
ΔG_{NUCL}	activation energy for nucleation of bulge or double kink	51d′, i, p″
$\Delta\mathcal{G}_{\mathrm{DIS}}$	free enthalpy per unit length of dislocation	51-6, 51g″
$g(\sigma/\mu)$	normalized activation free enthalpy	43l′
H	enthalpy	
ΔH	activation enthalpy (also "activation energy")	41-4b, 41l, m, 43t
h	partial strain hardening rate	33ee
	also: height of partial kink	51-6
i, j	vector and tensor subscripts	
K	effective resisting force of discrete obstacle	25a, g′, 52j
K_x, K_y, K_θ	— components of elemental force	52g″, h, 5-I
K_i	force exerted on body at surface	21h, i
k	Boltzmann's constant, $k = 1.38 \times 10^{-23}$ J/K	21e

	also: parameter in particle resistance laws	52-7 through 14
k_P	Hall-Petch parameter	24i
L	distance between especially strong obstacles	24i, 24-6, 33y, z
	also: specimen length	64a
$\mathscr{L}$	any length of dislocation	23f, 24h, 42r, 51-6
l	average inter-obstacle spacing	25aa
l_e	center-to-center spacing of two obstacles along dislocation, also average of same	25-1, 25jj, 44i
l_n	length of dislocation touching n obstacles ($\sigma = 0$)	25-17
$\mathscr{M}$	mass per unit length of dislocation	31a, k, l, n
$\mathscr{M}_{KINK}$	mass per unit length of kink	31m, o
M_{KINK}	total mass of kink	42u
m	relative stress sensitivity of the strain rate	34r, 43c, 61b
	(exponent in pheno. relation)	34h
m_o, m_G	contributions to m	45a, b, 62c, 63g
N	number of vibrational modes of dislocation	42o
N	number of dislocation segments per unit volume	
N_{WAIT}, N_m	waiting and mobile segment density	33a, c, s
$\dot{N}_{NUCL}$	nucleation rate per unit volume	51ee
n	exponent in phenomenological relation $\dot{\gamma}(\sigma)$	61f
	also: negative exponent in obstacle profile law $\tau(\Delta a)$	43v
n	number: e.g., dislocations in pile-up	24j, p
n_j	unit vector: perpendicular to surface	21i
	perpendicular to slip plane	22b
P	fraction of peaks in τ_{LINE}-map below σ	25-12
$\delta P, P$	fraction of segments released (per unit time)	33a, p
P_t, P_σ, P_τ	partial derivatives of P	33e, f, g, h, j
$\overrightarrow{P}_t, \overleftarrow{P}_t$	forward and reverse activation rate	45f
p	exponent in pheno. relation $\Delta G(\sigma)$	43w
p′	— same for $\Delta G(K)$	44l
p	hydrostatic pressure	43d
Q	operationally defined activation energy	61a, u
δQ	heat flowing into body	21a
q	exponent in pheno. relation $\Delta G(\sigma)$	43w

R	radius of curvature of dislocation (avg. or local)	23-5, 24-2, 25s
	also: phonon scattering radius	31u, v
r	exponent in pheno. relation $\Delta G(\sigma)$	43x′
r	radius of spherical particle	25ff
	also: partial recovery rate	33ff
r_o	inner cut-off radius in disl. energy	23h
r_P	inner cut-off radius in phonon scattering	31w
S	symbol for the stable equilibrium state	41-1, 41a, 42-1
S	entropy	21b, f
S_1, S_2, S_3	structure parameters	1a, b
S_o	total entropy of activation	41i
ΔS	activation entropy	41k, o′, o″, 42n, 43s
ΔS_{DIS}	entropy associated with dislocation vibrations	42l
s	normalized plane glide resistance (discrete obstacles)	25ii
T	temperature	21b
T_o	characteristic temperature $T_o(F_o, \dot{\gamma})$	45o, 51ll
T_{DEBYE}	Debye temperature	31-1
T_v	temperature below which quantum effects may occur	42k
t	time	31cc
t_{ACC}	time constant in equation of motion	31aa
t_{RUN}	running time between obstacles in jerky glide	33n
t_{WAIT}	inverse of total release rate $\dot{P}$	33r
U	symbol for the unstable equilibrium state	41-1, 41a, 42-1
U	internal energy	21a, g
U_o	total internal energy of activation	41j, 61f
$\mathcal{U}$	internal line energy of disl. at rest	31j
$\mathcal{U}_v$	internal line energy of moving disl.	31j
u_i	displacement (of surface element)	21h
V	total volume of body	21j, 22c
V_o	constant in phenomenological relation	34u
ΔV	activation volume (pressure effects)	43d, e′
v	velocity of dislocation	31j, r, 31cc
v_o	— initial value	31dd
$\bar{v}$	avg. disl. velocity in time, space	32b, f, k, o, q
$\bar{v}_m$	velocity averaged over mobile dislocations only	33u
v_L	Lüders front velocity	64a

$\bar{v}_{RUN}$	velocity averaged over running disl.	33k
$v_S \equiv v_{SOUND}$	terminal velocity of screw dislocations	31e, 34i
v_t, v_l	transverse and longitudinal speed of sound	31l
W	work done on body (only in virtual variation: δW)	21a, h, j
ΔW	activation work	41-1, 41d, 44e
$\Delta W'$	apparent activation work	43k, 61b′
w	width of discrete obstacle	25-1, 25ff
	also: interaction range	25-15
	also: width of kink	51-6
	also: width of Lüders front	64b
X	outer cut-off radius in disl. line energy	23h
	also: any distance along quasi-straight disl.	23-4, 23q, 25-4
x	coordinate along avg. disl. direction	23-2, 23q
x_{KINK}	average spacing of kinks	32r
Y	distance perpendicular to quasi-straight dislocation	25-4, 25f
	also: normalized coordinate	51j, k
y	coordinate, direction of average dislocation motion	23a, 31a, 51-1
Δy	activation distance	44c
y_{BACK}	distance moved by emitted dislocation before source can operate again	32t, v, 33z, aa
y_m	distance moved by dislocation before it is trapped	32t, 33y
y_{RUN}	"forward" distance moved after release	33c
y_{STOP}	distance moved coasting under inertia	31-2, 31dd
y_o	average depth of obstacle	25-1, 31ff
Z	partition function	21e
z	coordinate perpendicular to slip plane	

Greek letters

α	angle between line direction and Burgers vector	23k
β	bow-out angle	24f′, 25-7, 51g
γ	"shear" or "glide": amount of engineering shear strain produced by dislocation glide	22c
γ_o	macroscopic shear produced in waiting time	33d
$\dot{\gamma}_o, \dot{\gamma}_H$	constants in pheno. relations	34k, 61e′, 61g′, s
δ	depth of linear barrier	24-3, 24-5, 27b

ϵ, ϵ_{ij}	macroscopic strain tensor	21k, l, m, 64c
$\lvert\epsilon\rvert$	amount of unconstrained misfit strain	52d
ϵ_L	Lüders strain	64a
$\Delta\epsilon_{ij}$	activation strain	43e
η	separation of partials in extended dislocation	27b, 2-III
θ	angle betw. disl. and particle interface	52-5, 6, 52h
	also: work-hardening rate $d\tau/d\gamma$ at standard T and $\dot{\gamma}$	44n′
θ'	— same at zero temperature	44n
Θ	work-hardening rate $d\sigma/d\epsilon$	64c
κ	local curvature of dislocation line	23g, j, 25l
λ	wavelength of periodic linear barrier	31-3, 4, 32d, 51-1
Λ	mean-free-path (of kinks)	51aa
Λ_{pp}	phonon-phonon mean-free-path	31w
μ	shear modulus in line energy of screw dislocation	23h, 2-I
μ°	— same extrapolated to T = 0 K	41-5
μ'	shear modulus in slip plane and slip direction	31e, 3-I, 42h, 51c
ν	Poisson's ratio	23i
ν_{eff}	— effective value in edge energy, incl. elastic anisotropy	2-I
ν_D	Debye frequency	31i
ν_E	Einstein frequency	31h
$\nu_{FRIEDEL}$	dislocation attempt frequency according to Friedel	42f
ν_G, ν_H	frequency factors in disl. activation	42a, b, g, j
ν_{NUCL}	freq. factor for bulge nucleation	51w′
ν_0	ground frequency of vibrating dislocation segment	42d
ξ	running coordinate along disl. line	23a, 23-4, 25-7
ρ	mass density of material	31e
	dislocation length per unit volume:	
ρ_m	mobile dislocation density	32m, aa, 33q, 63g
ρ_{RUN}	density of running dislocations	33k
ρ_{SOURCE}	density of linear dislocation sources	32t, u, 33y
ρ_{WAIT}	density of waiting dislocations	33b, c
$\dot{\rho}^+$	*generation rate* of running dislocation (not net change)	33x
σ	applied stress *resolved in slip plane and direction*	22d
σ_{ij}	applied stress tensor in arbitrary coordinate system	21i, o, p
σ_{IJ}^{INT},qz	internal stress (see τ_{IJ}^{INT})	21w,y

σ_{ij}^{LOC}	total local stress tensor	21n, o, w
σ_{eff}	"effective stress" in continuous glide	32g, i
σ_0	constant in phenomenological relation	34k, v
σ_{LIM}	stress at which terminal velocity is reached	31z
τ	glide resistance	22e
$\tilde{\tau}$	mechanical threshold (abbrev. for $\hat{\tau}_{PLANE}$)	22i, 43w", 52
$\hat{\tau}$	amplitude of element glide resistance	32d
τ_{ij}	deformation resistance	21u
τ_{ij}^{INT}	deformation resistance due to internal stresses	21y
τ_{BACK}	back stress in pile-up	24m,n
τ_{DYN}	dynamic threshold	31-4
τ_{ELEM}	element glide resistance	23-2, 23b, 25-10
τ_{FLOW}	flow stress (also abbreviated τ)	44o
τ_{IDEAL}	ideal (or "theoretical") shear strength	34j, 51c
τ_{INT}	internal stress from mobile disl.	32e, l, bb
τ_u	athermal glide resistance plateau	43-6
τ_{LINE}	line glide resistance	23c, 25-10, 31a, 41a
τ_P	Peierls stress	51a, b
τ_{PLANE}	plane glide resistance	24i, 25-10, 25dd, ww, 44a, b
τ_{SELF}	dislocation self stress	23e, f, j
τ_{STOR}	average element glide resistance	22g, 45j
$\tilde{\tau}_{THERM}$	thermal shear stress amplitude	31t
τ_1, τ_2	line or plane resistance due to one mechanism	24-6, 24i, 33i', 43w''' 44-9, 10, 11
$\Delta\tau$	difference in glide resistance from two mechanisms	24-6
ϕ	half the cusp angle at a discrete obstacle	25g, v, 25-4, 52-5
χ	free energy per unit area:	
χ_{APB}	— of antiphase-boundary	52b
χ_{FAULT}, χ_{SF}	— of (stacking) fault	27c, 2-III
χ_{INT}	— of interface (precipitate-matrix)	52f, g
ψ	complement of bow-out angle β	23-4, 5, 25-7
Ψ	dissipation function ($\delta\Psi$ only)	21r, s, t, v, 22f
$\omega_A \equiv \omega_{ATGM}$	an atomic frequency	31f
Ω	atomic volume	31i, q, 34l