Official symbols and nomenclature of The Society of Rheology

The 12 tables that follow are the result of the hard work of the Ad Hoc Committee on Official Nomenclature and Symbols (John M. Dealy, Chair; Jeffrey Morris, Faith Morrison, and Dimitris Vlassopoulos) that was appointed by The Society of Rheology Executive Committee in 2012. The last major revision was done in 1984; this supersedes all prior versions, including the one published on pp. 253–265 of volume 39 of this journal in 1995. In the course of their work, the committee consulted numerous prominent rheologists working in specialized areas of rheology. These tables of Official Nomenclature and Symbols were approved for distribution here and online by The Society of Rheology Executive Committee in February 2013.

Ralph H. Colby, Editor

TABLE I. Steady simple shear (viscometric flows).

Name	Definition	Symbol	SI units[a]
Direction of flow (simple shear)	Figure 1	x_1	m
Displacement in the x_1 direction	Figure 1	X_1	m
Direction of velocity gradient (simple shear)	Figure 1	x_2	m
Neutral direction (simple shear)		x_3	m
Shear stress	F/A	σ	Pa
Shear strain	$\mathrm{d}X_1/\mathrm{d}x_2$	γ	—
Shear rate	$\mathrm{d}v_1/\mathrm{d}x_2$	$\dot{\gamma}$	s^{-1}
Viscosity	$\sigma/\dot{\gamma}$	$\eta(\dot{\gamma})$	Pa s
Yield stress		σ_y	Pa
Yield strain		γ_y	—
First normal stress difference	$\sigma_{11} - \sigma_{22}$	N_1	Pa
Second normal stress difference	$\sigma_{22} - \sigma_{33}$	N_2	Pa
First normal stress coefficient	$N_1/\dot{\gamma}^2$	$\Psi_1(\dot{\gamma})$	Pa s^2
Second normal stress coefficient	$N_2/\dot{\gamma}^2$	$\Psi_2(\dot{\gamma})$	Pa s^2
Normal stress ratio	$-N_1(\dot{\gamma})/N_2(\dot{\gamma})$	$\Psi(\dot{\gamma})$	—
Zero-shear viscosity (limiting low shear rate viscosity)	$\eta\ (\dot{\gamma} \to 0)$	η_0	Pa s
Critical molecular weight for entanglement effect on η_0		M_C	—[b]
Limiting high shear rate viscosity	$\eta\ (\dot{\gamma} \to \infty)$	η_∞	Pa s
Zero-shear first normal stress coefficient	$\Psi_1\ (\dot{\gamma} \to 0)$	$\Psi_{1,0}$	Pa s^2
Power law index	$\sigma = K\lvert\dot{\gamma}^{n-1}\rvert\dot{\gamma}$	n	—
Consistency	(see previous line)	K	Pa s^n

[a]SI allows either a dot between units or a space, as used here.
[b]IUPAC recommends *molar mass* (MM), which has SI units of g/mol. But *molecular weight* (MW) is widely used, and ACS accepts both terms. However, MW is in fact a dimensionless ratio that is numerically very close to MM (g/mol), and one cannot "change its units." The number often called "molecular weight (kg/mol)" is actually MW/1000 (no units). This quantity can properly be called *molar mass* with units of kg/mol.

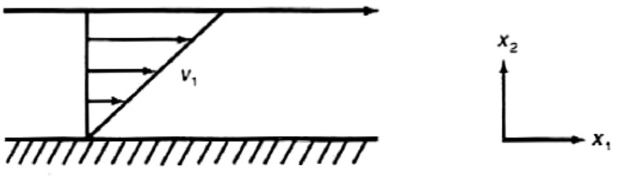

FIG. 1. Simple shear.

TABLE II. Linear viscoelasticity.

Name	Definition	Symbol	Units
Simple shear			
Shear modulus of a solid	σ/γ	G	Pa
Relaxation modulus (shear)	$\sigma(t)/\gamma$	$G(t)$	Pa
Relaxation spectrum	—[a]	$H(\tau)$	Pa
Memory function	$-\mathrm{d}G(\mathrm{s})/\mathrm{ds}$	$m(\mathrm{s})$	Pa s^{-1}
Creep compliance (shear)	$\gamma(t)/\sigma$	$J(t)$	Pa^{-1}
Equilibrium compliance of solid	$J(t) \quad (t \to \infty)$	J_{e}	Pa^{-1}
Recoverable compliance	$J(t) - t/\eta_0$	$J_{\mathrm{r}}(t)$	Pa^{-1}
Steady-state compliance of fluid	$J(t) - t/\eta_0 \quad (t \to \infty)$	J_{s}^0	Pa^{-1}
Molecular weight for entanglement effect on J_{s}^0	—[b]	$M_{\mathrm{C}}{}'$	—
Retardation spectrum	—[c]	$L(\tau)$	Pa^{-1}
Small-amplitude oscillatory shear			
Strain amplitude	$\gamma(t) = \gamma_0 \sin\omega t$	γ_0	—
Loss angle (phase angle)	$\sigma(t) = \sigma_0 \sin(\omega t + \delta)$	δ	rad
Stress amplitude	$\sigma(t) = \sigma_0 \sin(\omega t + \delta)$	σ_0	Pa
Complex modulus	$G' + iG''$	G^*	Pa
Absolute magnitude of G^*	σ_0/γ_0	$\lvert G^*\rvert$ or G_{d}	Pa
Storage modulus	$G_{\mathrm{d}} \cos\delta$	G'	Pa
Loss modulus	$G_{\mathrm{d}} \sin\delta$	G''	Pa
Complex viscosity	$\eta' - i\eta''$	η^*	Pa s
Absolute magnitude of η^*	$\sigma_0/\omega\gamma_0$	$\lvert\eta^*\rvert$	Pa s
Dynamic viscosity (in phase with strain rate)	G''/ω	η'	Pa s
Out-of-phase (with strain rate) component of η^*	G'/ω	η''	Pa s
Complex compliance	$J' - iJ''$	J^*	Pa^{-1}
Absolute magnitude of J^*	$\gamma_0/\sigma_0 = 1/G_{\mathrm{d}}$	$\lvert J^*\rvert$	Pa^{-1}
Storage compliance	$(\gamma_0/\sigma_0)\cos\delta$	J'	Pa^{-1}
Loss compliance	$(\gamma_0/\sigma_0)\sin\delta$	J''	Pa^{-1}
Plateau modulus	—[d]	G_{N}^0	Pa
Tensile extension			
Net tensile stress	$\sigma_{zz} - \sigma_{rr}$	σ_{E}	Pa
Hencky strain	$\ln(L/L_0)$	ε	—
Hencky strain rate	$\mathrm{d}(\ln L)/\mathrm{d}t$	$\dot{\varepsilon}$	s^{-1}
Tensile relaxation modulus	$\sigma_{\mathrm{E}}(t)/\varepsilon_0$	$E(t)$	Pa
Tensile creep compliance	$\varepsilon_0(t)/\sigma_{\mathrm{E}}$	$D(t)$	Pa^{-1}

[a] $G(t) = \int_{-\infty}^{\infty} H(\tau)[\exp(-t/\tau)]d(\ln\tau)$.
[b] IUPAC recommends *molar mass* (MM), which has SI units of g/mol. But *molecular weight* (MW) is widely used, and ACS accepts both terms. However, MW is in fact a dimensionless ratio that is numerically very close to MM (g/mol), and one cannot "change its units." The number often called "molecular weight (kg/mol)" is actually MW/1000 (no units). This quantity can properly be called *molar mass* with units of kg/mol.
[c] $J(t) = \int_{-\infty}^{\infty} L(\tau)[1 - \exp(-t/\tau)]d(\ln\tau) + t/\eta_0$.
[d] Because there is not a true plateau in $G(t)$ or $G'(\omega)$, G_{N}^0 is inferred from $G'(\omega)$ and $G''(\omega)$ using methods reviewed by Liu *et al*. [Polymer **47**, 4461–4479 (2006)].

TABLE III. Shift factors for time–temperature superposition.

Name	Definition	Symbol	SI units
Vertical shift factor[a]	$b_T G'(T, \omega a_T) = G'(T_0,\omega)$	b_T	—
Horizontal shift factor	$b_T G'(T, \omega a_T) = G'(T_0,\omega)$	a_T	—
First WLF coefficient	$\log_{10} a_T = \dfrac{-c_1(T-T_0)}{c_2+(T-T_0)}$	c_1	—
Second WLF coefficient	$\log_{10} a_T = \dfrac{-c_1(T-T_0)}{c_2+(T-T_0)}$	c_2	K
Activation energy for flow	$a_T(T) = \exp\left[\dfrac{E_a}{R}\left(\dfrac{1}{T}-\dfrac{1}{T_0}\right)\right]$	E_a	kJ/mol

[a]The vertical shift factor b_T should be $T_0\rho_0/T\rho$, where ρ is mass density, $\rho_0 = \rho(T_0)$, or b_T should be set equal to one. It should not be used as a fitting parameter.

TABLE IV. Nonlinear viscoelasticity in shear.

Name	Definition	Symbol	SI units
Stress relaxation (step strain)			
Strain amplitude		γ_0	—
Relaxation modulus (nonlinear)	$\sigma(t)/\gamma_0$	$G(t, \gamma_0)$	Pa
Damping function in shear	$G(t, \gamma_0)/G(t)$	$h(\gamma_0)$	—
First normal stress relaxation function		$N_1(t, \gamma_0)$	Pa
Second normal stress relaxation function		$N_2(t, \gamma_0)$	Pa
First normal stress relaxation coefficient	$N_1(t,\gamma_0)/\gamma_0^2$	$\Psi_1(t,\gamma_0)$	Pa
Second normal stress relaxation coefficient	$N_2(t,\gamma_0)/\gamma_0^2$	$\Psi_2(t,\gamma_0)$	Pa
Start-up shear (at fixed shear rate)			
Shear stress growth function		$\sigma^+(t,\dot\gamma)$	Pa
Shear stress growth coefficient	$\sigma^+(t,\dot\gamma)/\dot\gamma$	$\eta^+(t,\dot\gamma)$	Pa s
First normal stress growth function	$\sigma_{11}-\sigma_{22}$	$N_1^+(t,\dot\gamma)$	Pa
First normal stress growth coefficient	$N_1^+(t,\dot\gamma)/\dot\gamma^2$	$\Psi_1^+(t,\dot\gamma)$	Pa s^2
Second normal stress growth function	$\sigma_{22}-\sigma_{33}$	$N_2^+(t,\dot\gamma)$	Pa
Second normal stress growth coefficient	$N_2^+(t,\dot\gamma)/\dot\gamma^2$	$\Psi_2^+(t,\dot\gamma)$	Pa s^2
Stress ratio	$N_1(\dot\gamma)/\sigma(\dot\gamma)$		—
Cessation of steady shear	$\dot\gamma = 0$ from $t = 0$		
Shear stress decay function		$\sigma^-(t,\dot\gamma)$	Pa
Shear stress decay coefficient	$\sigma^-(t,\dot\gamma)/\dot\gamma$	$\eta^-(t,\dot\gamma)$	Pa s
First normal stress decay function	$\sigma_{11}-\sigma_{22}$	$N_1^-(t,\dot\gamma)$	Pa
First normal stress decay coefficient	$N_1^-(t,\dot\gamma)/\dot\gamma^2$	$\Psi_1^-(t,\dot\gamma)$	Pa s^2
Second normal stress decay function	$\sigma_{22}-\sigma_{33}$	$N_2^-(t,\dot\gamma)$	Pa
Second normal stress decay coefficient	$N_2^-(t,\dot\gamma)/\dot\gamma^2$	$\Psi_2^-(t,\dot\gamma)$	Pa s^2
Creep and creep recovery (recoil)			
Creep compliance	$\gamma(t,\sigma)/\sigma$	$J(t,\sigma)$	Pa^{-1}
Steady-state compliance[a]	$J(t\to\infty,\sigma)$	$J_s(\sigma)$	Pa^{-1}
Recoverable strain (after t_o when $\sigma\to 0$)	$\gamma[t_0,\sigma]-\gamma[t,\sigma]$ $\quad t > t_0$	$\gamma_r(t',\sigma)$ $\quad t' \equiv t - t_0$	—
Ultimate recoil	$\gamma_r(t'\to\infty,\sigma)$	$\gamma_\infty(\sigma)$	—
Steady-state recoverable compliance[a]	$\gamma_\infty(\sigma)/\sigma$	$J_s(\sigma)$	Pa^{-1}

[a]Although measured in different ways, the steady-state compliance and the steady-state recoverable compliance should be equal to each other according to the Boltzmann principle.

TABLE V. Nonlinear viscoelasticity in extension.

Name	Definition	Symbol	SI units
Tensile (uniaxial) extension			
Engineering strain[a]	$(L - L_0)/L_0$	ε	—
Engineering stress[a]	F/A_0	σ	Pa
Young's modulus of a solid	σ/ε	E	Pa
Net tensile stress (true) (see Fig. 2)	$\sigma_{zz} - \sigma_{rr}$	σ_E	Pa
Hencky strain of a liquid	$\ln(L/L_0)$	ε	—
Hencky strain rate	$d\varepsilon/dt$	$\dot{\varepsilon}$	s^{-1}
Tensile stress growth function		$\sigma_E^+(t,\dot{\varepsilon})$	Pa
Tensile stress growth coefficient	$\sigma_E^+(t,\dot{\varepsilon})/\dot{\varepsilon}$	$\eta_E^+(t,\dot{\varepsilon})$	Pa s
Extensional viscosity	$\eta_E^+(t,\dot{\varepsilon}) \quad (t \to \infty)$	$\eta_E(\dot{\varepsilon})$	Pa s
Tensile creep compliance	$\varepsilon(t)/\sigma_E$	$D(t,\sigma)$	Pa^{-1}
Recoverable strain (after t_0 when $\sigma_E \to 0$)	$\varepsilon[t_0,\sigma] - \varepsilon[t,\sigma] \quad t > t_0$	$\varepsilon_r(t',\varepsilon) \quad t' \equiv t - t_0$	—
Biaxial extension (symmetrical)			
Biaxial strain	$\ln(R/R_0)$	ε_B	—
Biaxial strain rate	$d(\ln R)/dt$	$\dot{\varepsilon}_B$	s^{-1}
Net biaxial stretching stress	$\sigma_{rr} - \sigma_{zz}$	σ_B	Pa
Biaxial stress growth function		$\sigma_B^+(t,\dot{\varepsilon}_B)$	Pa
Biaxial stress growth coefficient	$\sigma_B^+(t,\dot{\varepsilon}_B)/\dot{\varepsilon}_B$	$\eta_B^+(t,\dot{\varepsilon}_B)$	Pa s
Biaxial stress decay coefficient	$\sigma_B^-(t,\dot{\varepsilon}_B)/\dot{\varepsilon}_B$	$\eta_B^-(t,\dot{\varepsilon}_B)$	Pa s
Biaxial extensional viscosity	$\sigma_B^+(t \to \infty,\dot{\varepsilon}_B)/\dot{\varepsilon}_B$	$\eta_B(\dot{\varepsilon}_B)$	Pa s
Biaxial creep compliance	$\varepsilon_B(t)/\sigma_B$	$D(t,\sigma_B)$	Pa^{-1}

[a]In the mechanics literature, the same symbols are often used for both engineering and true stress and strain, but they are only equivalent in the limit of very small deformations.

TABLE VI. Rheometry.

Name	Definition	Symbol	SI units
Capillary rheometers			
Apparent wall shear stress	$P_d R/2L$	σ_A	Pa
Apparent wall shear rate	$4Q/\pi R^3$	$\dot{\gamma}_A$	s^{-1}
Wall shear stress	$-\sigma_{rz}\ (r = R)$	σ_w	Pa
Wall shear rate	$-dv/dr\ (r = R)$	$\dot{\gamma}_w$	s^{-1}
Cone-plate rheometers			
Cone angle	Figure 2	β	rad
Angular displacement	Figure 2	ϕ	rad
Angular velocity	$d\phi/dt$	Ω	rad/s
Torque	$2\pi R^3 \sigma_{\varphi\theta}/3$[a]	M	N m
Normal thrust		F_z	N

[a]Approximation valid for $\beta < 0.1$ rad.

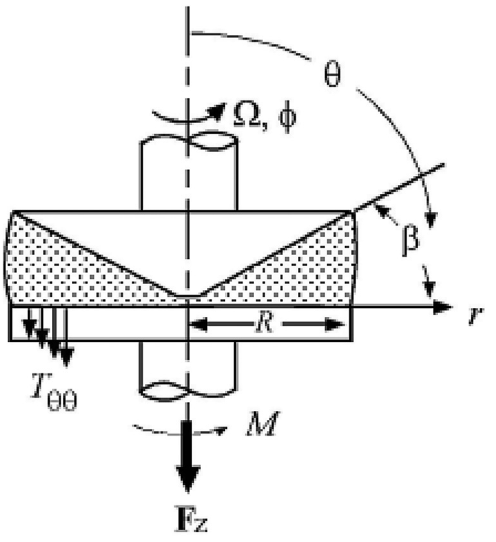

FIG. 2. Symbols describing cone-plate geometry.

TABLE VII. Solutions.

Name	Definition	Symbol	SI units
Concentration		c	kg m^{-3} or kg/m^3
Viscosity of solvent		η_s	Pa s
Relative viscosity	(η/η_s)	η_r	—
Specific viscosity	$(\eta_r - 1)$	η_{sp}	—
Reduced viscosity	η_{sp}/c	η_{red}	m^3 kg^{-1} or m^3/kg
Intrinsic viscosity	$\lim\limits_{\substack{\dot{\gamma} \to 0 \\ c \to 0}} \eta_{red}$	$[\eta]$	m^3 kg^{-1}
Viscosity of matrix		η_m	Pa s

TABLE VIII. Suspensions (see also Péclet Number in Table XII).

Name	Definition	Symbol	SI units
Volume fraction solid	$V_{solid}/V_{suspension}$	ϕ	—
Local stress tensor		$\boldsymbol{\sigma}(x,t)$	Pa
Total bulk stress	$\Sigma^f + \Sigma^p$	Σ	Pa
Fluid contribution		Σ^f	Pa
Particle contribution		Σ^p	Pa
First normal stress difference	$\Sigma_{11} - \Sigma_{22}$	N_1	Pa
Second normal stress difference	$\Sigma_{22} - \Sigma_{33}$	N_2	Pa
Particle pressure	$-\frac{1}{3}(\Sigma_{11}^p + \Sigma_{22}^p + \Sigma_{33}^p)$	Π	Pa
Hydrodynamic particle stress		Σ^H	Pa
Interparticle stress		Σ^{IP}	Pa
Brownian stress		Σ^B	Pa
Fluid viscosity		η_f	Pa s
Effective viscosity of suspension	$\Sigma_{12}/\dot{\gamma}$	η	Pa s
Relative viscosity	η/η_f	η_r	—
Particle contribution to η_r		η_P	Pa s
Maximum packing fraction[a]	(see note)	ϕ_{max}	—

[a]The maximum packing fraction for monodisperse spheres is thought of as the limiting value of the solid fraction for which shear flow can occur, implying that the effective viscosity diverges above this point. As a practical matter for measurement, ϕ_{max} is a measure of a statically stable packing of the particles and is not a precisely known quantity. It varies from random loose packing, $\phi_{rep} \approx 0.55$, to random close packing, $\phi_{rep} \approx 0.64$; the frictional properties at the particle surfaces may thus play a role in the observed packing. For polydisperse spheres, ϕ_{max} is generally larger than for the monodisperse case.

TABLE IX. Interfacial and surface rheology (see also Boussinesq Number in Table XII).

Name	Definition	Symbol	SI units
Interfacial tension		$\sigma_{\alpha\beta}$	N/m = Pa m
Surface pressure	$\sigma_{\alpha\beta,0} - \sigma_{\alpha\beta}$	Π	N/m = Pa m
Interfacial shear stress	F^s/L	σ^s	Pa m
Interfacial shear strain	dX_1/dx_2	γ^s	—
Interfacial shear rate	dv_1/dx_2	$\dot{\gamma}^s$	s^{-1}
Interfacial dilatational strain	$\ln(A/A_0)$	α^s	—
Interfacial dilatational strain rate	$d(\ln A)/dt$	$\dot{\alpha}^s$	s^{-1}
Steady shear and dilation			
Interfacial shear viscosity	$\sigma^s/\dot{\gamma}^s$	η^s	Pa s m
Interfacial dilatational viscosity	$\sigma^s/\dot{\alpha}^s$	κ^s	Pa s m
Simple shear			
Interfacial shear modulus	σ^s/γ^s	G^s	Pa m
Relaxation modulus (shear)	$\sigma^s(t)/\gamma^s$	$G^s(t)$	Pa m
Pure dilation			
Interfacial dilatational modulus	σ^s/α	K^s	Pa m
Dilatational storage modulus	$\sigma^s(t)/\alpha$	$K^s(t)$	Pa m
Gibbs elasticity (surfactants)	$d\sigma_{\alpha\beta}/d(\ln A)$	E_Π	Pa m
Small-amplitude oscillatory shear			
Strain amplitude	$\gamma^s = \gamma_0^s \sin \omega t$	γ_0^s	—
Phase angle (loss angle)	$\sigma^s(t) = \sigma_0^s[\sin(\omega t + \delta)]$	δ	rad
Stress amplitude	(see "Interfacial shear stress" above)	σ_0^s	Pa m
Complex interfacial modulus	$G^{s\prime} + iG^{s\prime\prime}$	G^{s*}	Pa m
Absolute magnitude of G^{s*}	σ_0^s/γ_0^s	$\lvert G^{s*}\rvert$	Pa m
Storage modulus	$\lvert G^{s*}\rvert \cos\delta$	$G^{s\prime}$	Pa m
Loss modulus	$\lvert G^{s*}\rvert \sin\delta$	$G^{s\prime\prime}$	Pa m
Complex viscosity	$\eta^{s\prime} - i\eta^{s\prime\prime}$	η^{s*}	Pa s m
Absolute magnitude of η^{s*}	$\sigma_0^s/\omega\gamma_0^s$	$\lvert\eta^{s*}\rvert$	Pa s m
Dynamic viscosity (in phase with strain rate)	$G^{s\prime\prime}/\omega$	$\eta^{s\prime}$	Pa s m
Out-of-phase (with strain rate) component of η^{s*}	$G^{s\prime}/\omega$	$\eta^{s\prime\prime}$	Pa s m
Small-amplitude oscillatory dilation			
Dilatational strain amplitude	$\alpha^s = \alpha_0^s \sin \omega t$		—
Complex dilatational modulus	$E^{s\prime} + iE^{s\prime\prime}$	E^{s*}	Pa m
Absolute magnitude of E^*	σ_0^s/α_0^s	$\lvert E^{s*}\rvert$	Pa m
Storage dilatational modulus	$\lvert E^{s*}\rvert \cos\delta$	$E^{s\prime}$	Pa m
Loss dilatational modulus	$\lvert E^{*}\rvert \sin\delta$	$E^{s\prime\prime}$	Pa m
Complex dilatational viscosity	$\kappa^{s\prime} - i\kappa^{s\prime\prime}$	κ^{s*}	Pa s m
Absolute magnitude of κ^{s*}	$\sigma_0^s/\omega\delta_0^s$	$\lvert\kappa^{s*}\rvert$	Pa s m
Dynamic viscosity	$E^{s\prime\prime}/\omega$	$\kappa^{s\prime}$	Pa s m
Out-of-phase component of κ^{s*}	$E^{s\prime}/\omega$	$\kappa^{s\prime\prime}$	Pa s m
Other properties			
Creep compliance (shear)	$\gamma^s(t)/\sigma^s$	$J^s(t)$	$Pa^{-1}\ m^{-1}$
Equilibrium compliance of solid	$J^s(t)\ (t \to \infty)$	J_0^e	$Pa^{-1}\ m^{-1}$
Recoverable compliance	$J^s(t) - t/\eta_0^s$	$J_r^s(t)$	$Pa^{-1}\ m^{-1}$
Steady-state compliance of fluid	$J^s(t) - t/\eta_0^s \quad (t \to \infty)$	J_0^s	$Pa^{-1}\ m^{-1}$
Extensional viscosity	$\eta_E^s(t, \dot{\varepsilon}^s) \quad (t \to \infty)$	$\eta_E^s(\dot{\varepsilon}^s)$	Pa s m

TABLE X. Molecular description of entangled polymers.

a	tube diameter; average entanglement spacing/mesh size ($\sqrt{\langle R^2\rangle_0 M_e/M}$)
b_K	Kuhn segment length[a]
f	tension in a chain segment
f_{max}	maximum tension in a chain segment
k_B	Boltzmann's constant, 1.38×10^{-23} J/K
L	mean tube contour length
M	molecular weight, dimensionless[b]
M	molar mass g mol^{-1}[b]
M_e	molecular weight between entanglements[c] ($\rho RT/G_N^0$)
N_K	number of Kuhn segments in equivalent freely jointed chain[a]
N_A	Avogradro's number, 6.023×10^{23} molecules/mole
p	packing length[d] ($M/[\langle R^2\rangle_0 \rho N_A]$)
R	end-to-end distance of polymer molecule
R_{max}	fully extended chain length[a]
s	tube contour variable (curvilinear coordinate along tube)
$\boldsymbol{S}$	tube orientation tensor
Z	number of entanglements per molecule (M/M_e)
Greek letters	
α	dilution exponent for M_e
ζ	friction coefficient
ζ_0	monomer friction coefficient
λ	chain stretch; stretch ratio
ξ	correlation length; characteristic size scale (blob size)
τ_d	reptation (tube disengagement) time
τ_e	Rouse time of an entanglement strand (τ_R/Z^2)
τ_p	relaxation time of the pth mode (p is the mode index)
τ_R	Rouse stress relaxation time $(\varsigma N^2 b^2)/(6\pi^2 kT)$[e]

[a]b_K and N_K are defined by the following relationships: $\langle R^2\rangle = b_K^2 N_K R_{max} = b_K N_K$.
[b]IUPAC recommends *molar mass* (MM), which has SI units of g/mol. But *molecular weight* (MW) is widely used, and ACS accepts both terms. However, MW is in fact a dimensionless ratio that is numerically very close to MM (g/mol), and one cannot "change its units." The number often called "molecular weight (kg/mol)" is actually MW/1000 (no units). This quantity can properly be called *molar mass* with units of kg/mol.
[c]This is the definition originally proposed by John Ferry. The following alternative definition was introduced much later, but its use can be confusing, and it should not be used: $M_e \equiv \frac{4}{5}\rho RT/G_N^0$.
[d]For a discussion of p, see Fetters *et al.* [Macromolecules **27**, 4639 (1994)].
[e]For linear molecules, Doi and Edwards call τ_s the Rouse rotational relaxation time, for which they use the symbol τ_r, which is conjectured to be equal to $2\tau_R$.

TABLE XI. Stress and strain tensors.

Total stress tensor	$\boldsymbol{\sigma}$
Extra stress tensor	$\boldsymbol{\tau}$
Strain tensor for linear viscoelasticity	$\boldsymbol{\gamma}$
Cauchy tensor	$\boldsymbol{C}$
Finger tensor	$\boldsymbol{B}$ or $\boldsymbol{C}^{-1}$
Doi–Edwards strain tensor	$\boldsymbol{Q}$
Rate-of-strain tensor[a]	$\dot{\boldsymbol{\gamma}} = \nabla v + \nabla v^T$

[a]An alternative definition, equal to $\frac{1}{2}\dot{\boldsymbol{\gamma}}$, is widely used in fluid mechanics and is acceptable, but the symbol $\boldsymbol{D}$ should be used for this tensor to avoid confusion: $\boldsymbol{D} \equiv \frac{1}{2}(\nabla v + \nabla v^T)$.

TABLE XII. Dimensionless groups used to describe experimental regimes.

Deborah number[a]	De (characteristic time of fluid)/(duration of deformation)
Weissenberg number[a,b]	Wi (characteristic time of fluid) × (rate of deformation) = e.g., $\tau\dot{\varepsilon}$ or $\tau\dot{\gamma}$
Boussinesq number	Bo (surface shear stress)/[(bulk subphase shear stress) × (perimeter length along which the surface shear stress acts)]
Péclet number[c]	Pe $\equiv \dot{\gamma}a^2/D_o$ (a = particle radius; D_o = particle diffusion coefficient)

[a]The definitions and uses of these groups are explained in detail in "Weissenberg and Deborah Numbers—Their definition and use," Rheol. Bull. (The Society of Rheology) **79**(2), 14 (2010).
[b]The Weissenberg number has sometimes been considered to be (N_1/σ). However, this is a ratio of dependent rather than independent variables and thus describes data rather than experimental conditions. The quantity (N_1/σ) is often called the *stress ratio*.
[c]Characteristic rate of advection over the rate of diffusion for suspensions in shear flow.