Process Intensification and Green Chemistry – Notation and Symbology

Chapter 8: Microreactors

Roman symbol	Definition	Units	Comments
a	fluid-fluid specific interfacial area	m^2/m^3	
A	area	m^2	
A_0	area at time or sequence 0	m^2	
A/A_0	relative interfacial area		
A/V	surface area of heat transfer to reaction volume	1/m	
b	constant for chaotic mixers		
c	molar concentration	mol/m^3	
$\bar{c}$	mean molar concentration	mol/m^3	
c_∞	molar concentration upon perfect mixing	mol/m^3	
c_i	molar concentration of species i	mol/m^3	
Ca	capillary number		
d	inner channel diameter	m	
d_h	hydraulic diameter	m	
D or D_m	molecular or mass diffusivity	m^2/s	
De	Dean number		
De_{cr}	critical Dean number		
$\vec{E}$	electric field	V/m	
f	frequency of perturbation	1/s	
F_{CF}	centrifugal force	N	
F_{CP}	centripetal force	N	
G or Q_G	gas phase flow rate	m^3/s	
k_L	gas/liquid mass transfer coefficient	m/s	
$k_L a$	volumetric mass transfer coefficient for gas/liquid	1/s	
$k_{ov} a$	volumetric mass transfer coefficient for liquid/liquid	1/s	
L	mixing path length	m	
L or Q_L	liquid phase flow rate	m^3/s	
L_D	diffusion distance	m	
n	number of layers or number of sequences		
p	pressure	Pa	
Pe	Peclet number		
$\dot{q}$	overall specific rate of heat transfer	W/m^3	
r	radius of channel	m	
r_c	radius of curvature for curved channels	m	
Re	Reynolds number		
Re_{cr}	critical Reynolds number		
Re_D	Reynolds number of the dispersed (non-wetting) phase		
Sc	Schmidt number		

St	Strouhal number		
t	time	s	
$t_{chaotic}$	characteristic time for chaotic mixing	s	
t_{mx}	characteristic mixing time	s	
T	temperature	°C or K	
ΔT	temperature difference	°C or K	
u or U	mean velocity	m/s	
u_D	mean velocity of dispersed (non-wetting) phase	m/s	
u_G	gas phase mean velocity	m/s	
u_L	liquid phase mean velocity	m/s	
U	overall heat transfer coefficient	W/m^2/K	
V	reactor volume	m^3	
Greek symbols	**Definition**	**Units**	**Comments**
α	mixing efficiency		
δ	film thickness	m	
ε_D	ratio of volumetric flow rate of dispersed phase to the volumetric flow rates of dispersed and continuous phases combined		
θ	contact angle		
θ_{adv}	advancing contact angle		
θ_{aprnt}	apparent contact angle		
θ_{rec}	receding contact angle		
λ	interface stretching factor		
μ	dynamic viscosity	Pa s	
ν	kinematic viscosity	m^2/s	
ν_D	kinematic viscosity of dispersed (non-wetting) phase	m^2/s	
ρ	specific gravity or density	kg/m^3	
σ	surface tension	N/m	
σ_{L2-S}	surface tension between liquid 2 and wall surface S	N/m	
σ_{L1-L2}	surface tension between liquids 1 and 2	N/m	
σ_s	mixing performance		
σ^2	variance in the concentration	mol^2/m^6	
σ^2_{max}	maximum variance in the concentration	mol^2/m^6	
Abbreviation	**Definition**		
MEMS	microelectromechanical systems		
OCM	overlapping crisscross micromixer		
PDMS	polydimethylsiloxane		
PFA	perfluoroalkoxy		
RTD	residence time distribution		
SAR	split and recombine		
SHM	staggered herringbone mixer		