Corrigendum to "Materials Engineering and Science for Chemical and Materials Engineers"

Corrections to First Printing

(Some corrections have been incorporated into the Second and Third printings. Those corrections identified since the Third printing are identified with an open square bullet).

Chapter 1

☐ Page 10, Table 1.5 Values for some compounds may be incorrect, especially melting point for Al_2O_3.

- Page 11, Example Problem 1.1, line 2, should reference Table 1.4 not 1.3.
- Page 31, line 8 from bottom, after "The simple cubic structure," replace "sometimes called the rock salt structure because it is the structure of rock salt (NaCl)," with "which is the basic structural unit of many primitive cells, including NaCl,".
- Page 40, line 12, "Negative directions are indicated by an overbar..." should be followed by $\left[1\,\bar{1}\,1\right]$,".
- Page 41, CLE 1.2, Person 2, "Calculate the volume of a single Pa unit cell." (Insert "a").
- Page 44, CLE 1.3, Second answer (upside-down text) should be 1.56×10^{15} atoms/cm^2.
- Page 31, line 8 from bottom, after "The simple cubic structure," replace "sometimes called the rock salt structure because it is the structure of rock salt (NaCl)," with "which is the basic structural unit of many primitive cells, including NaCl,".
- Page 36, Table 1.9, Element 81 (bottom row) should be Tl (Tee - el).
- Page 52, Table 1.5, line 2, column 3, for edge dislocation, propagation direction should be "$\perp$ to dislocation line," not "$\parallel$ to dislocation line,".
- Page 53, line 4, replace "HCP" with "FCC".
- Page 85, line after Eqn. 1.58, should read "or, in terms of the mass (in grams) of species with molecular weight M_i, $m_i = N_i M_i$"
- Page 86, CLE 1.6, first line of answer (upside-down text), the final term in the numerator should have the number 1000 in parenthesis, not 100:

$$\overline{M}_w = \frac{28{,}000(2800) + 15{,}000(3000) + 4800(1200) + 7200(3600) + 1000(1000)}{56{,}000}$$

- Page 99, line 10 from the bottom, 6th word should be "polymers" not "polymols".
- Page 123, Figure 1.90 Page number on reference should be 1, not 31.
- Page 130, Problem 1.I.3. Change answer choices to pH 3, 9 and 11.

☐ Page 131, Problem 1.I.15. Second question should read "Which of these molecules can have two or more forms?"

- Page 135, line 2 from top, add the word "incommensurate" before "adsorbed" so that it reads: "a single, incommensurate, adsorbed layer..."

Chapter 2

- Page 148, Example Problem 2.1, second equation from the bottom, the term on the left hand side of the equation should be ΔG_L^{ideal}, not ΔG_L^0.
- Page 169, line 7 from the bottom through line 3 from the bottom should read (changes are highlight in italics):
  "...now a two-phase region (L + α) with *two* degrees of freedom in Figure 2.16 is now a two-phase region with *one degree* of freedom, just as in a binary-component diagram,

since the temperature has now been fixed and one degree of freedom has been lost. The *one degree* of freedom in this region *is a* composition, with the *other* compositional *variables* being fixed when the *first is* determined."

☐ Page 193, CLE 2.5, change all terms "weight fraction" to "mole fraction." Appears in lines 2, 9, and 18.

- Page 193, CLE 2.5. The last two sentences in the text box should be inverted and come below "Answer" as they are part of the answer.
- Page 211, Problem 2.I.6, add "at 200°C" after "free cutting brass".

Chapter 3

☐ Page 217, Eq. 3.4, the equilibrium constant, K, should be inverted:

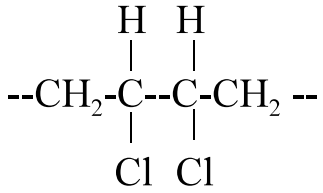
$$K = \frac{k_2}{k_1} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

- Page 229, Eq. 3.24, the RHS of the equation should have a minus sign:

$$E - E^\circ = \frac{-RT}{nF} \ln\left(\prod_i a_i^{v_i}\right)$$

- Page 232, Eq. 3.30, cap *T* should be lc *t* in the denominator.
- Page 231, CLE 3.2, before "Person1" (end of problem statement) add:
  "The exchange current density for iron in acidified solution is 10^{-8} A/cm^2."
- Page 231, CLE 3.2. The *Answers* should be changed to read:
  E_H = 0.000 V - 0.08 log(I/10^{-6}); E_{Fe} = -0.440 V + 0.07log(i/10^{-8})
  $i_c = 10^{-4}$ A/cm^2; $r_{Fe} = 5.18 \times 10^{-10}$ mol/cm^2
- Page 233, last line of text, Eq. (2.11) should be Eq. (2.12)
- Page 234, after Eq. 3.32, omit sentence "If we assume....". Eq. (3.31) in the next sentence should be Eq. (2.12).
- Page 249, Table 3.6, under the column "Stepwise Polymerization" add at the bottom:
  "Long reaction times necessary to obtain high molecular weight"
  and under the column "Addition Polymerization" add at the bottom:
  "Long reaction times do not affect molecular weight much, but do increase yield"

☐ Page 250, the right hand side of Eqn. 3.70, the molecular structure should be:



i.e., the H and Cl on the terminal carbon should be moved to the second carbon from the right.

☐ Page 251, Eqn. 3.75 should read

$$\frac{-d[M]}{dt} = k_p\left(\frac{fk_d[I]}{k_t}\right)^{1/2}[M]$$

- Page 252 CLE 3.4, Lots of them!
  Third equation should read:

$$\frac{dR_p}{R_p} = \frac{E_{a,p} + \frac{E_{a,d}}{2} - \frac{E_{a,t}}{2}}{RT^2}dT$$

  Answers should read:
  $E_{a,p}$ = 24.9 kJ/mol; $E_{a,t}$ = 16.8 kJ/mol; $E_{a,d}$ = 141 kJ/mol;
  dR_p/R_p = {[24.9+141/2-16.8/2]$(10^3)(1)/(8.314)(323)^2$} × 100 = 10%°C^{-1}

☐ Page 253, Eqn. 3.79 should read

$$\frac{1}{\bar{x}_n} = \frac{Y\left(k_t f k_d[\mathrm{I}]\right)^{1/2}}{k_p[\mathrm{M}]} + \sum_i \frac{k_{tr,i}[\mathrm{A}]}{k_p[\mathrm{M}]}$$

- Problem 3.I.5, p. 249, strike words "and weight average" and change "degrees" to "degree".
- Page 276, CLE 3.5, the answer should read "*Da* is about 10^{-9}," not 10^{-8}.
- Page 282, Problem 3.I.3 (e) should be "316 stainless steel" not "315 stainless steel."
- Page 283, Problem 3.III.2
  In the accompanying figure, the label on the x-axis should read: $1/T \times 10^3$ [K^{-1}]
- Page 284, Problem 3.III.3
  Inert liquid in Reactor II should read "8.00 m^3 water" not "8.00 m^3 benzene".

Chapter 4

- Page 289, line 1 should read "(in Pa·s)" instead of "(in poise)".
- Page 294, CLE 4.1:
  Line 2 should read "the equation in the following form:"
  Line 6 should read "or using a spreadsheet..." instead of "using matrices..."
  Person 1 instructions should read, "Determine the VFT parameters *A*, E_μ/R, and..."

☐ Page 296, Equation 4.16, replace "*m*" with "μ":

$$K_\theta = K_0\mu_\theta / \mu_0$$

- Page 377, Problem 4.III.2, should read:
  "Use a spreadsheet to solve for the three constants in the Vogel-Fulcher-Tammann equation using the data in Cooperative Learning Exercise 4.1. Show your work."
- Page 315, CLE 4.5, the third line of the Answer (upside-down text) should read "values on the order of 100" instead of "values on the order of 1000".
- Page 333, CLE 4.8, replace "°C" with "K" (three places in problem statements).

- Page 342, Example Problem 4.2, the first equation, (line 9) should read:

$$Nu = 0.26(Re)^{0.6}(Pr)^{0.3}$$

- Page 376, problem statement should read "a 2-mm-thick, 1 cm^2 section...".
- Page 376, Problem 4.II.1, the equation should read:

$$\ln k = 0.01T + 0.5$$

- Page 387, Problem 4.III.3, line 3 (first data point) should read "ln μ = 13.3" not "ln μ = 3.3"

Chapter 5

- Page 380, line 6 from the bottom replace "Voigt" with "Maxwell".
- ☐ Page 386, Equation 5.7, the last term in each line should be "γ_{yz}", not "ε_{yz}".
- Page 387, line 1 and 2 from top, should read (changes in italics):
  "number of *two* independent moduli, corresponding to the *two* forms of stress: *normal* and shear."
- Page 389, CLE 5.2, third line of the answer (upside-down text), third word should be "Hooke's" not "Hook's).
- Page 397, line 3 from bottom, "the presence of grain boundaries also affects..." not "affect".
- Page 426, CLE 5.7, line 1 of Answer (upside-down text) should read:

$$\sigma_c \text{ (MgO)} = [(210 \times 10^9 \text{ N/m}^2)(1.0 \text{ J/m}^2)/(10^{-10} \text{ m})]^{1/2} = 56.5 \text{ GPa} \approx E/4;$$

(replace 0.66 in the second term with 1.0, and answers at the end of calculation)

- Page 426, CLE 5.7, line 4 of Answer (upside-down text) should read:

" generally $E > \sigma_c > E/10$."

(replace less than signs with greater than signs).

- ☐ Page 458, CLE 5.10, second line of the Answer (upside-down text) should read:

"$a_T(453) =$" not "$a_T(423) =$"

- Page 534, Problem 5.I.7, line 2, temperature should be 800°C, not 880°C.
- Page 534, Problem 5.II.2, the problem statement has (potentially) four corrections:

  1) "distance of two Fe atoms is 0.2490 nm..."

  should read:

  "distance of two Fe atoms is 0.2480 nm..."

  2) "separation distance increases to 0.1489 nm."

  should read:

"separation distance increases to 0.2489 nm."

3) Add " if the modulus in this direction is 125 GPa." to the end of the problem statement.

4) the last line should have the punctuation corrected to be one sentence:
"stress of 1000 MPa, if the modulus in this direction...."

- Page 535, Problem 5.III.1, line 5-6 should read:

"The data from all tests were obtained from cylindrical samples with a gauge length of 20 mm."

Not

"The data from all tests were obtained from rectangular...."

Chapter 6

☐ Page 601, "For free atoms like Na and Mg...." should read "For free atoms like Mg..." Na has unpaired electrons.
- Page 612, CLE 6.6, line 13, replace "Eq. (6.59)" with "Eq. (6.61)"
- Page 645, Figure 6.83, replace all alphas (α) with betas (β).
- Page 679, Problem 6.II.3, line4, switch *a* and *c* such that it reads "...in the *c* and *a* sites..."
- Page 680, Problem 6.III.2, line 7, second word from end is "an" not "a"; line 8, remove the word "gradient".

☐ Page 680, Problem 6.III.2, the page number in the reference should be 8948, not 8984.

Chapter 7

- Page 695, Example Problem 7.1, line 2, should be "2000 lb ..." not "200 lb...".

☐ Page 773, CLE 7.3, first answer (upside-down text) should be $Q = 4.06 \times 10^{-3}$ cm^3/s.

Answer to Selected Problems

- Page 903, Problem 2.1.4, change to "880 g α, 120 g Fe_3C"
- Page 903, Problem 2.1.5, change the answers to part b) to grams: *"*m_L = 813 g, m_α = 187 g;"
- Page 904, Problem 4.I.4, change answers to "4.7; 9.0"
- Page 904, Problem 4.III.1 should be labeled 4.III.3 (answer is correct).
- Page 904, Problem 5.I.3, should read "310×10^3 MPa".
- page 904, problem 5.III.1,should read "For sample GBC50 a) 3 mm; b) 0.28; c) m= 389 kg"
- page 905, problem 6.I.11, answers should read "$n_{\text{fused silica}}$ = 1.46, $n_{\text{dense flint}}$ = 1.65"

☐ Page 905, Problem 6.I.8, a) $B_0 = 1.89 \times 10^{-4}$ Tesla; (H = 150 A/m is an intermediate answer)

Back inside cover

"Frequently Used Physical Constants"

- Bohr magneton, "Value" should be 9.27400899 × 10^{-24} not 927.400899 × 10^{-24}