BOOKS

The Chemistry and Physics of High Energy Reactions, Ernest J. Henley and Everett R. Johnson, Washington, D.C., Press, Washington, D.C. (1969). vii + 475 pages. $18.50.

Don't be thrown off by the title of this book. It's really about radiation chemistry and not about any one of several other topics it may call to mind. Although the authors may consider the title accurate, this reviewer believes it does the book a disservice in not attracting the desired audience.

Both authors have had extensive experience in several aspects of the overall subject, and they have written a book intended primarily for the classroom. As such, the text contains many illustrative problems worked out in great detail, and most of the chapters are followed by a set of problems to be worked out by the student.

The introductory chapters offer a general background on radioactivity and radiation, radiation physics, and radiation sources. This coverage is broad and very brief so that supplementation by the instructor or by some previous study of pertinent areas of nuclear physics is desirable. The succeeding chapters, which are more fully developed, cover dosimetry; primary events in radiation chemical reactions; special experimental techniques in radiation chemistry; radiation chemistry of gases, water and aqueous solutions, and liquid hydrocarbons (three separate chapters); radiation effects in solids; radiation-induced polymerizations; and radiation effects in polymers. A brief concluding chapter discusses well-known actual and potential industrial applications.

The treatment of radiation effects in solids is novel in a book of this kind and is a valuable addition. In the chapter on radiation-induced polymerizations, much background information on polymerization types, mechanisms, and on polymer properties is given before discussing the radiation-induced reactions.

The book should be useful for classroom instruction and for personal reference. On the other hand, it is not represented as an up-to-date research treatise. The book suffers occasionally from some loose writing, which makes

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LETTERS TO THE EDITOR

TO THE EDITOR

In a recent article, Sylvester and Rosen (*4*) stated that both coefficients *K* and *K'* in their Equation (1) increase with the area contraction ratio β for $0 < \beta < 0.1616$ and that there must be maxima in the *K* and *K'* vs. β relations, because the coefficients should vanish as β goes to one.

The above statements seem to be unjustified for the following reasons. First, their conclusion is based on experimental data which contain a single value of β for each fluid studied. Any such conclusion should be based on experimental data containing a number of different values of β for a given fluid, instead of a single value of β for a number of different fluids. This is because different fluids can give rise to different values in coefficients *K* and *K'* with the same value of β. Secondly, from a physical point of view, it is very difficult, although not impossible, to envision how *K* and *K'* should go through maxima as β varies. It is my impression that Sylvester and Rosen (*4*) appear to have drawn their conclusion in order to justify their statement that *K* and *K'* increase with β for $0 < \beta < 0.1616$.

Recently, this writer (*1*) made an experimental study of the influence of β (0.1111, 0.2777, 0.01234, 0.00694) on the entrance pressure drops in polymer melts (which are viscoelastic) flowing through circular tubes. The material employed for the experiment was high density polyethylene at 180°C. The apparatus and experimental procedure employed are as described in the writer's earlier papers (*2*, *3*), in which it was given that the capillary section is 0.125 in. in diam. and has an *L/D* ratio of 20.

Using the same notation as in (*4*), the following correlation

$$\frac{\Delta P_{ent}}{\rho V^2/2g_c} = K'/N_{Re} \qquad (1)$$

was obtained for all values of β studied, as shown in Figure 1. It is to be noted that the polymer melts tested follow the power law ($K_p = 1058.4$ and $n = 0.28$) over the range of shear rate (180 ~ 800 sec.$^{-1}$), and that N_{Re} was calculated from

$$N_{Re} = \frac{\rho\, D^n\, V^{2-n}}{K_p\, 8^{n-1} \left(\dfrac{3n+1}{4n}\right)^n} \qquad (2)$$

It seems worth noting that the existence of the correlation by Equation (1) is in agreement with the creeping flow analysis by Weissberg (*5*). This is quite understandable in view of the exceedingly low values of Reynolds numbers encountered.

It is then possible to plot *K'* against β, as shown in Figure 2. Note that in this case *K'* depends on only β because the power law index *n* is fixed. It is clearly seen from Figure 2 that *K'* monotonically decreases over the range of β tested, $0.00694 \leqq \beta \leqq 0.1111$, contrary to what Sylvester and Rosen (*4*) stated. Furthermore, it is to be expected from Figure 2 that *K'* approaches zero as β approaches one, without passing through a maximum.

In conclusion, the experimental result shown in Figure 2 is nowhere close to what was stated by Sylvester and Rosen (*4*). The author is inclined

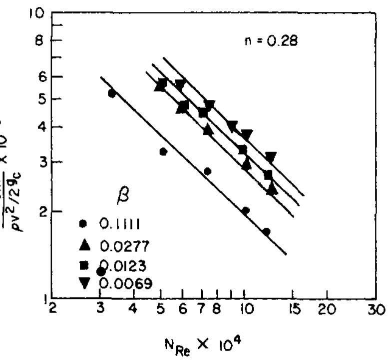

Fig. 1. Dimensionless entrance pressure drop vs. Reynolds number for high density polyethylene at 180°C.

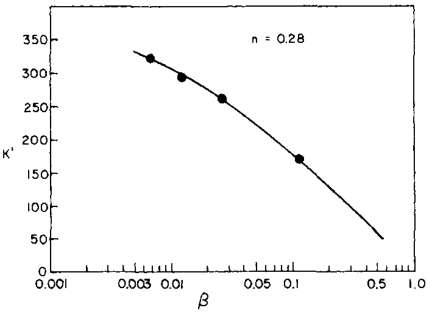

Fig. 2. Dimensionless coefficient *K'* vs. area contraction ratio.

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The introduction to the book offers a list, with extensive references, of examples of industrially important processes in which gas absorption is accompanied by chemical reaction. Chapter one presents basic principles of diffusion and solubility in liquids. Of particular value here is a discussion of diffusion of electrolytes and of the effect of mixed electrolytes on diffusivity of the absorbing components. Chapter two gives some of the basic principles of reaction kinetics. In Chapter three, "Absorption into Quiescent Liquids," the author presents analytical solutions for absorption with reactions of first, second, and general order, both for irreversible and reversible reactions. Plots of enhancement factors for the various reaction cases, that is, the increase in absorption coefficient due to a chemical reaction over the nonreaction case, are given for a wide range of parameters. Many examples with completely calculated numerical results show how to use the results as well as the particular limitations of each of the solutions.

Chapter four discusses use of these solutions in analysis of results of experiments with apparatus, such as the laminar jet, wetted sphere, and wetted-wall column, and is particularly valuable for the discussion of the errors that may arise and caveats to be observed in interpreting data from each of these types of apparatus.

The next three chapters discuss similar topics as applied to absorption and reaction in agitated liquids. Various film, surface renewal models, and the variable age model associated with the author's name are discussed in both nonreacting and reacting systems. Examples and complete solutions for different kinetics are given. Comparison of results using film, Higbie, and Danckwerts' models are given for first-order reactions as well as for instantaneous irreversible reactions and for irreversible second-order reactions. Temperature effects and absorption with ionized reaction products also are discussed. As a compilation with numerous examples and references to the different types of models of absorption with reaction, this chapter alone is worth the price of the book.

The final three chapters discuss application to process equipment, including absorption in packed and plate columns, and the characteristics of various types of absorption equipment. Chapter ten, entitled "Some Examples of Reactions," gives complete analysis with numerical results for a number of practical absorbers and will be of particular interest to the practicing engineer. Some of the examples discussed are: absorption of carbon dioxide in various alkali solutions, absorption of chlorine in aqueous solutions, and oxygen reacting in reducing aqueous solutions. The book concludes with a chapter on desorption of gases.

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to believe that the dependence of K' on β for other fluids (e.g., dilute polymer solutions and Newtonian fluids) would also yield a similar trend to that shown in Figure 2.

NOTATION

D = tube diameter, in.
g_c = conversion factor, 32 lb.$_m$-ft./lb.$_f$-sq.sec.
K' = dimensionless coefficient
K_p = fluid consistency in the power law, lb.$_m$/in.-sec.$^{2-n}$
L/D = capillary length-to-diameter ratio
n = flow index in the power law, dimensionless
N_{Re} = Reynolds number, dimensionless
ΔP_{ent} = entrance pressure drop, lb.$_f$/sq.in.
V = average velocity of fluid, in./sec.
ρ = fluid density, lb.$_m$/cu.in.
β = ratio of capillary cross-section area to reservoir cross-section area

LITERATURE CITED

1. Han, C. D., unpublished work.
2. Han, C. D., M. Charles, and W. Philippoff, *Trans. Soc. Rheol.*, **13**, 455 (1969).
3. *Ibid.*, **14**, 393 (1970).
4. Sylvester, N. D., and S. L. Rosen, *AIChE. J.*, **16**, 964 (1970).
5. Weissberg, H. L., *Phys. Fluids*, **5**, 1033 (1962).

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TO THE EDITOR

In the interest of maintaining the quality of the *Journal*, I feel it necessary to call attention to a minor error in the recent article by Truesdell and Adler, "Numerical treatment of fully developed laminar flow in helically coiled tubes" (*1*). These authors repeatedly refer to "the Deans number" when consistency would require "the Dean number" after the original investigator (*2*). The terminology "Reynolds number," "Prandtl number," and "Schmidt number" has been used, at least in this country, since 1941 or earlier (*3*).

Curiously, Koutsky and Adler's "listing of important references through 1964" (*4*), as it is described in the subject article, makes only one peripheral reference to this dimensionless group. There it is called "a . . . Dean's number" and not defined. White, in his early paper (*5*), uses the phraseology "Reynolds number" but "Dean's criterion." Dean himself did not, of course, venture to give this dimensionless group a name.

Since it is too much to ask you or your associate editors to catch pecadillos of this kind, I appeal to your authors and reviewers for more care.

LITERATURE CITED

1. Truesdell, L. C., Jr. and R. J. Adler, *AIChE J.* **16**, 1010 (1970).
2. Dean, W. R., *Phil. Mag.* **4**, 208 (1927); **5**, 673 (1928).
3. Perry, J. H., Ed., "Chemical Engineers' Handbook," McGraw-Hill, New York (1941); also *American Standard* ASA Y10.12-1955.
4. Koutsky, J. A., and R. J. Adler, *Can. J. Chem. Eng.* **42**, 239 (1964).
5. White, C. M., *Proc. Roy. Soc.* (*London*) **A 123**, 645 (1929).

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