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

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

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

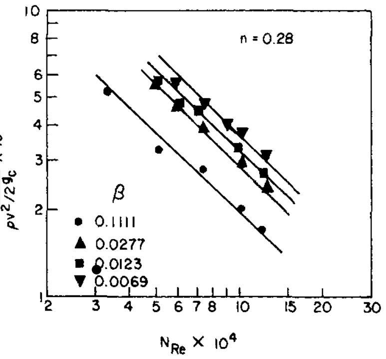

Fig. 1. Dimensionless entrance pressure drop vs. Reynolds number for high density polyethylene at 180°C.

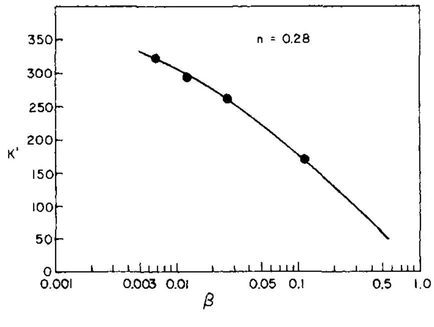

Fig. 2. Dimensionless coefficient K' vs. area contraction ratio.

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Sufficient Conditions for Stability of the Bernard Problem in Arbitrary Geometries

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Recently Catton and Edwards (*1*) and Davis (*2*) have used linearized stability analyses to find necessary conditions for stability of Newtonian fluids heated from below and contained in right circular cylinders or three-dimensional boxes, respectively. We wish to point out that the energy method of stability analysis (*3, 4*) can be used to prove that the sufficient conditions for stability coincide with the necessary conditions for stability for the geometries and boundary conditions considered in references *1* and *2*.

In fact, the energy method can be used to show that the necessary and sufficient conditions for stability coincide for arbitrary geometries if the following conditions are met (*3*):

1. The Boussinesq approximation is valid.
2. A stationary-state solution exists with a zero velocity and a temperature gradient that is linear, parallel to, and in the same direction as gravity.
3. The velocity perturbations satisfy either $V_j = 0$, or $V_i \cdot N_i = 0$, $V_j\, \partial V_j/\partial X_i\, N_i = 0$ at all finite boundaries.
4. The temperature perturbations satisfy the general equation $\partial T'/\partial X_i\, N_i + N_{Nu} T' = 0$ at all finite boundaries.
5. In any infinite directions the velocity and temperature perturbations are either periodic or decay asymptotically to zero. When these criteria are satisfied, the results obtained from a linear stability analysis with exchange of stabilities are necessary, and sufficient conditions for stability, and subcritical instabilities cannot occur.

NOTATION

N_{Nu} = Nusselt number
N_i = dimensionless outward directed normal
T' = dimensionless perturbation in temperature
V_j' = dimensionless perturbation in velocity
X_i = dimensionless general coordinate direction

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comprehension by novices difficult. The names of authors of literature references are often misspelled and in some cases are indexed twice or not at all.

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Gas-Liquid Reactions, P. V. Danckwerts, McGraw-Hill Book Co., New York (1970). 276 pages. $11.50.

Gas-liquid absorption in both reacting and nonreacting systems has been the subject of numerous experimental and theoretical studies in the past twenty years. The author has been noteworthy among those who have applied our increased understanding of kinetics and mass transfer to the development of coherent models for the design of gas-liquid contacting apparatus.

This book summarizes the results of such advances both by his own group and by many others. As a clear presentation of the subject from basic principles to design of process units, the book represents a significant contribution to the chemical engineering literature. It is suitable as a text for a graduate course in mass transfer operations and will also be valuable as a reference for the practicing engineer, because of the clear exposition of underlying theory and because of the large number of practical examples.

Although not so designated by the author, the book falls into three sections. The first four chapters discuss the elements of diffusion and absorption into quiescent liquids with simultaneous reaction obeying various kinetic laws. The second section discusses absorption into agitated liquids, an area in which the author has made significant contributions. Finally, the last four chapters discuss absorption with reaction in process equipment.

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