$\sqrt{gH} = 0.5$ *m/s is* small when compared with the smallest observed velocity which is equal to 4.7 m/s.

Finally, N_* is not influenced by the geometric parameters (D, L, internal structure of the injection device). But D and L influence the onset of oscillations. It should be only noticed that a disturbance induced by a transition of the flow pattern is larger when the diaphragm aperture is smaller and that the frictional pressure drop is nearly proportional to the length of the channel. Hence, a disturbance is easily amplified when D and L are small. Detailed results (Adler, 1975) are shown to follow these trends.

CONCLUSIONS

An oscillatory phenomenon induced by the introduction of a diaphragm in a horizontal air-water, two-phase flow was analyzed.

The experimental frequency is of the same order of magnitude as the frequency of a continuity wave. However, in our case, the void fraction profiles vary through the wave, while the spatial mean void fraction is constant.

The experimental frequency was shown to be given by an empirical formula in which only the mean superficial velocities of each phase and the length of the setup have an effect. This is thought to be characteristic of this type of instability.

NOTATION

α = local void fraction
D = aperture of diaphragm
g = acceleration of gravity
H = height of channel (= 24 mm)
L = length of setup
N, N_* = dimensional, nondimensional resonance frequency
p = pressure
t = time
$\bar{u}_G, \bar{u}_{G,m}, \bar{u}_{G,A}$ = mean superficial velocity of the gas phase for an arbitrary pressure, mean pressure of the setup, atmospheric pressure
$\bar{u}_L$ = mean superficial velocity of the liquid phase
x, y = Cartesian coordinate system (Figure 1), the origin 0 is at the beginning of the injection device, within the vertical symmetric plane of the channel and at the upper wall

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BOOKS

Gas-Solid Reactions, J. Szekely, J. W. Evans and H. Y. Sohn, Academic Press, 1976. 400 pages. price: $39.50.

This a textbook intended for graduate students majoring in metallurgy or chemical engineering with specific interest in gas-solid reactions. Of the eight chapters, the first five chapters (half the book) are devoted to the derivation of rate equations based on several idealized models of gas-solid reactions, with appropriate mathematical problems for exercise. In fact, the major emphasis in the book is on the mathematical treatment of heat and mass transfer accompanying various types of idealized gas-solid reactions with perhaps a biased slant to their grain model. Although the authors do caution the student that good judgment should be exercised in the application of theoretical rate equations to experimental data, they do not give adequate examples of departures from idealized reaction models that are often encountered even in well-thought out experiments. A conceptual analysis of a reaction to be studied is, of course, a priori requisite to the design of a particular experimental method, and the interpretation of the results, however, greater emphasis should have been made on frequently observed departures from idealized reaction models. However, the authors' mathematical treatment of the idealized gas-solid reactions is clearly stated, and the equations given for numerous types of reaction models will be of much value to those who study the gas-solid reactions. The review of past work on oxidation of metals and reduction of metal oxide is highly condensed. In fact, no mention is made of internal oxidation, sulfidation, nitriding, etc. of alloys which is a subject of some importance to the students of metallurgy. In Chapter 6 the authors give a broad outline of experimental techniques used in the study of gas-solid reactions. The principles of gas-solid reactions in multiparticle systems are adequately presented in Chapter 7. Some examples are given in Chapter 8 of gas-solid reactions of industrial importance, such as iron oxide reduction, roasting of sulfides, SO_2 absorption by solids, coal gasification and incineration of solid waste. These examples are intended for the student's orientation and not for detailed discussion of, for example, heat and mass transfer in the blast furnace stack. Graduate students and those in research laboratories investigating gas-solid reactions will find the book helpful in their endeavors.

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Heat Transfer, 4th Ed., J. P. Holman, McGraw Hill Book Company. 530 pages, price: $17.00.

This is a fine elementary treatment, excellent for a strong first course in heat transfer. Analytical, numerical, and em-