Table 2 also contains estimates of the rate and adsorption constants obtained from minimizing the sum of squares of conversion residuals by using directly the integrated form of the dual site model. These estimates were obtained by combining an equation solving routine with a nonlinear estimation routine so that the sum of squares of residual conversions could be minimized. As is often the case, the estimates thus obtained differ somewhat from the estimates obtained by the other two methods, which are also reported in Table 2. The estimates obtained by the direct nonlinear least squares analysis of the dual site model are generally considered to be better parameter estimates than those reported in the other two entries of Table 2.

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NOTATION

C_1 = intrinsic parameter not multiplied by conversion
C_2 = intrinsic parameter multiplied by the first power of conversion
C_3 = intrinsic parameter multiplied by the second power of conversion
F = molal feed rate, lb.-moles feed/hr.
K = thermodynamic equilibrium constant for overall reaction, atm.
K_A = equilibrium adsorption constant for alcohol, atm.$^{-1}$
K_W = equilibrium adsorption constant for water, atm.$^{-1}$
K_{wo} = sum of equilibrium adsorption constants for water and butylene, atm.$^{-1}$
k = forward rate constant for surface reaction, lb.-moles/(lb.-catalyst)(hr.)
p_A = partial pressure of alcohol, atm.
p_o = partial pressure of butylene, atm.
p_W = partial pressure of water vapor, atm.
r = reaction rate, lb.-moles/(lb.-catalyst)(hr.)
r_o = initial reaction rate for pure feed, lb.-moles/(lb.-catalyst)(hr.)
W = mass of catalyst, lb.
x = conversion, lb.-moles converted/lb.-mole feed
π = total pressure, atm.

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Comments on "Critical Flow of Liquid-Vapor Mixture*"

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Within the restrictions of the model, the authors present a good summary of equations involving two-phase quantities which have been repeatedly used by others, including the maximization of the two-phase flow through manipulation of the slip ratio. Furthermore, it is again noted that the conservation equations are not consistent in the evaluation of the critical flow rates. References noted below (published during the interval of the presentation of the paper and the publication in the *Journal*) will further orient the reader in gaining perspective of the status of the art on critical two-phase flow.

The important contribution claimed by the authors is that their treatment represents a *unified theory*. Although the relationship is now made in a somewhat cautious fashion to irreversible thermodynamics, this reader fails to grasp the justification of the thermodynamic arguments presented. The one-dimensional model almost precludes any basis for examining dissipation through velocity gradients, and consequently provides no insight on *rates* of entropy production.

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