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INFORMATION RETRIEVAL

Key Words: A. Theoretical-5, Experimental-5, Spraying-8, Drying-8, Heat Transfer-8, Design-8. B. Liquid-1,6, Gas-1,6, Particles-2,6, Atomizing-10, Trajectory-8,7, Heat Transfer-8,7. C. Solution-1, Slurry-1, Drying-8, Atomizing-10. D. Sodium Sulfate-1, Calcium Carbonate-1, Spraying-10, Drying-8. E. Atomizer-10, Pressure Nozzle-10, Two Fluid-Atomizer-10, Centrifugal Disk Atomizer-10, Spraying-8, Drying-8, Trajectory-8.

Abstract: A theoretical model of a spray dryer has been postulated, which is based on the premise that the trajectory of and heat transfer to the sprayed particles are determined by the fluid dynamics of the gas flowing with the spray. Experiments, involving several different sizes of dryers, have shown the applicability of this model to two-fluid, pressure-nozzle, and centrifugal-disk atomizers. The correlation obtained is suitable for use in the preliminary design of spray dryers.

Reference: Gluckert, F. A., **A.I.Ch.E. Journal, 8,** No. 4, p. 460 (September, 1962).

Key Words: Fluid Flow-, Nonisothermal Flow-6, Heated Flow-6, Transition-8, Pipe Flow-8, Tube Flow-8, Non-Newtonian Flow-8, Pseudoplastic Fluids-9, Power-Law Fluids-9, Carbopol-9, CMC-9, Flow Stability-7, Hydrodynamics-, Bingham Plastic Fluids-9.

Abstract: Johnson's treatment of the isothermal laminar-turbulent transition for pipe flow of pseudoplastic liquids is extended to include heated flows of pseudoplastic liquids in smooth tubes.

In comparing theoretical and experimental critical wall shear stresses and flow rates, it is found that the former are predicted within ± 3.87% and the latter within ± 6.7% for fluids with power-law constants n in the range 0.498 to 0.936 and mean temperature differences between 18.6° and 50.2°C.

A limitation is pointed out for the case of Bingham plastic fluids.

Reference: Hanks, Richard W., and E. B. Christiansen, **A.I.Ch.E. Journal, 8,** No. 4, p. 467 (September, 1962).

Key Words: Flow-8, Fluid Flow-8, Turbulence-8, Emulsions-9, Dispersions-9, Drops (Droplets)-9, Globules-9, Liquids-9, Fluids-9, Mixtures-9, Immiscible-, Properties (Characteristics)-, Physical Properties-, Pipes-10, Drops (Droplets)-7, Size-, Velocity-6, Interfaces-6, Surface Tension-6, Properties (Characteristics)-6, Physical Properties-6, Correlations-8, Design-8.

Abstract: Experiments have been performed to determine the largest drop that is stable in the turbulent flow of two immiscible liquids in a pipe. Correlation of the results shows that the drop size varies much more strongly with velocity and interfacial tension than is predicted by the Hinze-Kolmogoroff equation for drop breakup in isotropic turbulence. The correlation is useful for the design of pipeline reactors and other equipment in which drop size or interphase mass transfer rates are important.

Reference: Sleicher, C. A., Jr., **A.I.Ch.E. Journal, 8,** No. 4, p. 471 (September, 1962).

Key Words: Kinetics-9, Heterogeneous-9, Catalysis-9, Nickel-4, Hydrogen-1, Hydrogen-2, Alumina-4, Effectiveness-8, Porosity-8, Diffusion-8, Reactions-9, Rates-9,7, Low-, Temperature-8, Nitrogen-5, Fixed Bed-, Reactors-10, Heterogeneous-9, Reaction Mechanics-9, Reaction Kinetics-9, Physical Properties-8, Properties (Characteristics)-8, Surface-8, Adsorption-8, Metals-4, Aluminum Oxide-4, Oxides (Inorganic)-4, Pressure-6, Velocity-6, Size-6, Particles-6.

Abstract: Ortho-hydrogen was converted to para-hydrogen in a fixed-bed catalytic reactor operated at liquid nitrogen temperature. Rate of reaction data were obtained over a range of pressures, flow rates, and catalyst particle sizes. Catalyst employed was multiple-impregnation nickel on alumina material. External and pore diffusion resistances were evaluated as well as effectiveness factors. The surface rate was correlated on the basis of a reaction mechanism involving adsorption of molecular hydrogen and a controlling surface rearrangement on the catalyst surface.

Reference: Wakao, Noriaki, P. W. Selwood, and J. M. Smith, **A.I.Ch.E. Journal, 8,** No. 4, p. 478 (September, 1962).

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Dear Editor:

The data of Pauls, Comings, and Smith for the hydrogenation of ethylene [*A.I.Ch.E. Journal*, 5, 453 (1959)] show the effect of a temperature instability which went unnoticed because there was no direct measure of the catalyst temperature. For inlet temperatures of 34° to 72°C. the reaction rate doubled for each 9°C. rise in temperature. However the measured rate at 81°C. was nine times the rate at 72°C. and would have been even higher except that the conversion was almost complete. Heat transfer calculations show that the surface temperature of the pellets was 1° to 8°C. above the bed temperature for the first five runs and at least 80°C. above the bed temperature for last run. If most of the reaction occured in the first portion of the bed, the surface temperature may have been as high as 300° to 400°C. for the last run.

TABLE 1. DATA FROM TABLE 3 OF PAULS, COMINGS, AND SMITH

T_{in}, °C.	T_{out}-T_{in}, °C.	$r \times 10^5$, moles/ min., g.	Calculated value of T_s-T_g, °C.
34.5	0	1.9	0.8
43.2	0	3.7	1.6
50.4	0	4.3	2
61	0	9.7	4.8
72.5	0	17.7	8.4
81	2	158	76 (average for entire surface)

All runs at 1 atm., 814cc./min. total flow, and 73% hydrogen + 27% ethylene. The conversion was 99 to 100% for the last run.

The unstable point is reached when the rate of change of heat generation with surface temperature becomes equal to the rate of change of heat transfer with surface temperature. The critical temperature drop from surface to gas is $(T_s - T_g)_{\text{critical}} = RT^2/\Delta E$. Once this critical value is exceeded, the surface temperature rises until the reaction rate is limited by external or pore diffusion.

For the data cited the critical temperature drop is 21°C., and the predicted critical gas temperature is about 80°C., in agreement with the unstable behavior evident at 81°C. The exact critical gas temperature would be hard to predict, since the local heat transfer coefficient varies perhaps three to fourfold over the particle surface. With a low pellet conductivity some portions of the surface would become much hotter than others. Studies of exothermic reactions near the critical region might be a way of demonstrating the local variations of transfer coefficients in packed beds.

Sincerely yours,
Peter Harriott
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