

Schult G C A & Gates B C. Chemistry and engineering of catalytic hydrodesulfurization. *AIChE J.*—*Amer. Inst. Chem. Eng.* 19:417-38, 1973. [Department of Chemical Engineering, University of Delaware, Newark, DE]

Hydrodesulfurization is a catalytic reaction converting organic sulfur-bearing molecules and hydrogen into hydrogen sulfide and hydrocarbons. In removing the sulfur from the fuel, the reaction renders it clean burning, no longer a source of sulfur dioxide to pollute the atmosphere. In scale, hydrodesulfurization and related hydroprocessing operations are now the most important in petroleum refining. [The SCI® indicates that this paper has been cited in over 185 publications since 1973.]

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"The writing of this paper was initiated at the suggestion of W.H. Manogue, a member of a research committee of the American Institute of Chemical Engineers and a scout for reviews to appear in the institute's research journal. The arrival of George Schuit at the University of Delaware for a sabbatical year brought him—with 20 years of academic and industrial experience in hydrodesulfurization (mostly the inorganic chemistry of the catalyst)—into his first collaboration with Bruce Gates, a chemical engineer who had just joined the university from Chevron Research Company, where he

worked on hydrodesulfurization process development and engineering.

"Collaboration is one of the elements that characterizes much of the successful research and development in the complex subject of catalysis. The integration of the viewpoints of the chemist and the chemical engineer was worked out in the paper and was developed further in a textbook describing a set of the predominant catalytic processes in chemical and petroleum technology.¹

"The paper continues to be cited more than a decade after its publication because of the sustained technological interest and a steady influx of newcomers to the field, who use it as an introduction. The primary focus of the current scientific literature on hydrodesulfurization is the catalyst structure, and the paper is also cited frequently because the 'monolayer model' of the structure, first stated there, still provides a useful frame of reference, even though improved models have appeared since.

"Hydrodesulfurization is the best understood of the hydroprocessing reactions, which include hydrogenation, hydrodenitrogenation, hydrodeoxygenation, and hydrodemetallization. The need for hydroprocessing technology is increasing sharply as the petroleum industry adjusts to the available heavy feedstocks (such as those from Mexico and Venezuela) having high concentrations of sulfur, nitrogen, and metals. Hydroprocessing is now a major theme of the industry's research and development. Development of catalysts and processes for the heavy oils—and ultimately shale and coal—may be viewed as an evolution from the technology of hydrodesulfurization."

1. Gates B C, Katzer J R & Schult G C A. *Chemistry of catalytic processes*. New York: McGraw-Hill, 1979. 464 p.