

Preface

This issue of *Catalysis Today* is devoted to the ‘‘Periodic Operation of Catalytic Reactors’’. It is an opportune moment for it. Interest in the use of the unsteady state to improve reactor performance originated about 25 years ago at almost the same time in Europe, Japan, and North America. During this interval, interest in it has grown and so has a considerable literature concerning it. The first article in this issue reviews briefly the development of periodic operation with respect to reactor application. What was a curiosity and source of speculation 25 years ago has now evolved into an area of serious research as the first commercial applications start to appear. Du Pont de Nemours is currently constructing a maleic anhydride plant using a riser-fluid bed system in which the catalyst will be exposed periodically to separate feeds of butane and air.

In the lead article of the current issue, we the editors consider what constitutes periodic operation in reactors, define the variables introduced, and contemplate the types of periodic operation that can arise. Equipment used for these studies is examined and possible objectives of employing periodic operation are given.

The research team directed by Professor Amarglio in Nancy, France discusses a novel use of periodic operation to overcome the low-temperature thermodynamic limitations on methane coupling under steady operation. Recent experimental results are included and a detailed analysis is developed on how to beat the thermodynamic limitation.

A joint contribution from the University of Waterloo and University of New South Wales summarizes the accumulated literature on periodic

and unsteady operation of the Fischer–Tropsch synthesis, already amounting to nearly a dozen papers that include Ru, Fe, Co, and Mo as active catalysts. It is demonstrated that both rates and product distributions can be influenced significantly by periodic operation.

A paper from Professor Gulari and his co-workers at the University of Michigan critically reviews the catalytic oxidation of carbon monoxide and provides a mechanistic interpretation of some of the remarkable increases in oxidation rates that have been observed in the laboratory.

A program has been underway at the University of Minnesota, among other places, on applying chromatographic effects that can only be achieved under periodic operation. Professor Carr’s and Professor Bjorklund’s offering demonstrates the potential of a chromatographic reactor based on a moving bed and used with two different reaction systems.

From Drs. Klusáček and Stuchlý in Prague comes a contribution describing recent experiments on methanation of carbon monoxide under periodic and transient conditions. The results are aptly explained by blockage of reactive sites under steady-state operation that is reversed when the hydrogen and CO reactants are introduced separately in time. It appears that periodic operation has also provided an unusual opportunity for insight into the surface mechanism of this reaction.

The final contribution in this special issue deals with the effect of periodic operation on the performance of the catalytic muffler. It is not fully appreciated that this device has become the most widely used catalytic reactor now in existence.

Millions are in operation every moment. All of them operate periodically because of the air–fuel ratio control system employed. The observation is made that for this type of reactor, periodic operation is not beneficial and the reasons for this are developed.

As editors, we have been pleased by the response of many of the leading researchers in periodic operation for requests for contributions. Indeed, this issue spotlights a number of research-

ers who have contributed significantly to the field and continue to introduce advances.

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