PERP Program

May 1996

Chem Systems' Process Evaluation/Research Planning program has published a new report: ***Light Paraffin Dehydrogenation (94/95S2)***.

The laws of nature that govern the chemistry of paraffin dehydrogenation have conspired at length to present a formidable challenge to the process chemist and process engineer to manufacture a workable operation. However, the main commercial technologies, Catofin, Oleflex, STAR, Snamprogetti/Yarsintez dehydrogenation, and Linde have developed their own unique methods of overcoming the inherent difficulties in performing paraffin dehydrogenation to produce commercially viable processes.

These technologies, however, come at a price, and in the main, require large scales of operation to make economic sense. Each technology has its share of unique selling points. Although innovations are constantly being made to these processes, it is the view of Chem Systems that these processes will, in time, reach some cost performance limit. The only change to this situation will be a step change in process design and this is the theme of this report.

Stepping back from the process and focusing on the process chemistry and the catalysis required to achieve sustainable thermodynamics conversion have resulted in new catalysts with their own unique properties.

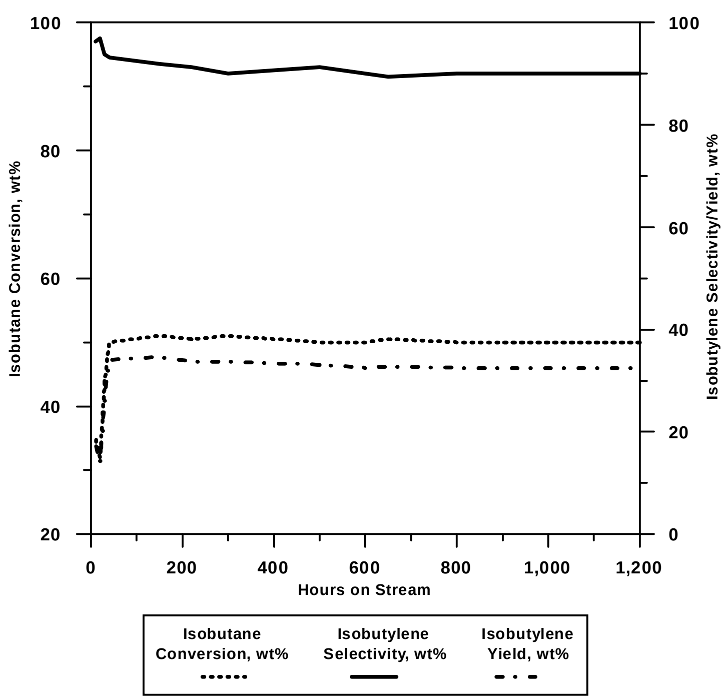
Both Mobil and BP Chemicals, separately, have developed zeolite-based catalysts, whereby dehydrogenation catalysts based on platinum alloys have been supported inside zeolite frameworks in a unique fashion. One of the alloyed species is incorporated into the zeolite synthesis itself. The final result is an excellent dispersion of alloyed metals within the zeolite structure. The zeolite in this case is nonacidic leading to minimal coking. The figure below shows the results of some catalyst activity trials that suggest that regeneration may not be required.

The final result is a long-lived catalyst (>1,200 hours on stream) suggesting the potential for developing a “throw away” catalyst. Such a catalyst would not require regeneration or the multiple reactor arrangements of most commercial systems. The complexity of the process would be reduced making for simpler operation. The overall effect would be a reduction in capital investment and operating costs.

In ***Light Paraffin Dehydrogenation***, Chem Systems develops a conceptual paraffin dehydrogenation process employing the new zeolite-based catalysts. Proposed process flow diagrams are shown along with economics comparing the conceptual process to a generic conventional dehydrogenation process. Our results indicate that at large scales, for example a plant feeding a 500 thousand metric ton MTBE unit, the new zeolite-based process shows a modest economic benefit. It is at smaller scales that the real economic impact can be seen.

As the scale of operation is reduced to below 100 thousand metric tons, the difference in production cost between conventional and the new zeolite-based technology is exaggerated. The cost advantage of zeolite-based dehydrogenation may allow this technology to be exploited for low to intermediate scale downstream specialty chemicals or polymers. Examples might include acrylonitrile (in the case of propylene), butyl rubber, polyisobutylene, *tertiary*-butylhydroperoxide, and pivalic acid. Polyisobutylene manufacture is examined in this report.

NOVEL ZEOLITE DEHYDROGENATION CATALYST: LIFE PERFORMANCE



Operating Pressure at 1.0 bara, 550°C, 4 to 7 WHSV