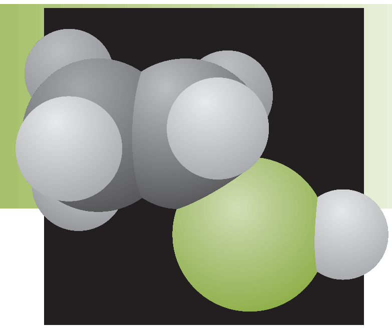
CHEMICALS

Project Fact Sheet



Selective Catalytic Oxidative Dehydrogenation of Alkanes to Olefins: Effective Catalysts

Benefits

- Saves 1 trillion Btu per year of energy by 2006
- Improves product selectivity
- Delivers olefin feedstocks
- Utilizes ethane wasted in steam cracking
- Lengthens the intervals between maintenance cycles
- Reduces CO_2 generation 10-fold; does not produce NOx
- Produces potential savings in downstream processing

Applications

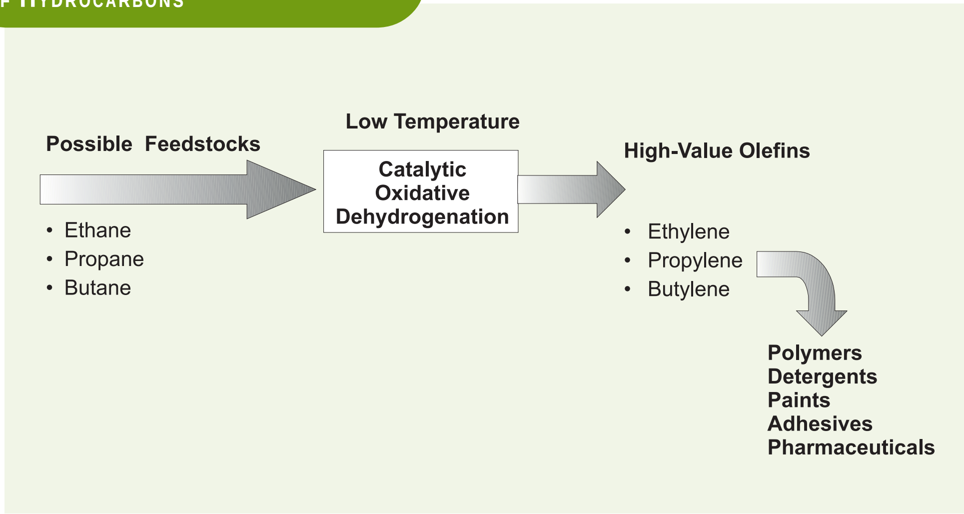
Primary application are production of ethylene, propylene, butenes and olefin derivatives. Cost-effective production of olefins (chemicals with carbon-carbon double bonds) would benefit the worldwide chemical industry. Although commercial reactors would have to be adapted to these processing changes, there will be substantial benefits to doing so.

Breakthrough catalyst research may revolutionize the way some major chemicals are produced

The new technology of catalytic oxidative dehydrogenation (ODH) may completely change the way some of the nation's most important organic chemicals are manufactured. The conversion of alkanes like ethane (a by-product of petroleum processing and present in natural gas) to olefins (ethylene, propylene, the butenes, and butadiene) is in great demand in the domestic and worldwide chemical industry. High operational costs and environmental issues have made this conversion profitable only on a very large scale. With successful development of ODH, high yields of olefins will be possible through the conversion of much smaller volumes of alkanes.

Compared with the conventional steam-cracking method of dehydrogenating alkanes to olefins and current catalytic dehydrogenation processes, ODH could reduce costs, lower greenhouse gas emissions, and save energy. Capital and operational efficiencies are gained by eliminating the need for a furnace and for decoking shutdowns, lowering operating temperatures, lessening material demands, conducting fewer maintenance operations, and using a greater proportion of the alkanes in the olefin conversion process.

The Oxidative Dehydrogenation of Hydrocarbons



Low temperature catalytic process can replace energy-intensive steam cracking, producing high-value chemicals.

Project Description

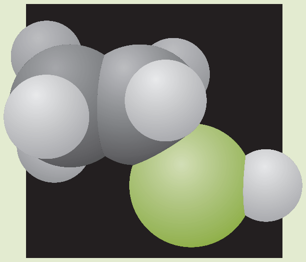
Goal: To develop a commercial catalyst that will conduct the ODH process at low temperatures in order to help meet the increased worldwide demand for a cost-effective olefin feedstock.

Theoretically, the ODH reaction produces, rather than consumes, energy. In practice, an effective catalyst is needed to reduce the energy required for activation of the unreactive alkanes, while avoiding over-oxidation of the olefins to combustion products. This project will focus on the expedient development of a catalyst that can meet industry's goals of good selectivity, economical productivity, and clean, continuous operation.

The research will begin with the analysis and characterization of four promising low-temperature catalysts already developed by Akzo Nobel. The approach will be to identify both selective and non-selective active sites on the catalysts, and to modify the materials to reduce or eliminate the non-selective sites. Computer-aided design tools developed by Molecular Simulations, Inc. will help guide this effort. Researchers will integrate the results of experiments and computer-based molecular simulations into a state-of-the-art protocol for optimizing the catalysts. In addition to evaluating the promise of these newly developed ODH catalysts, this assessment will include an updated economic analysis of the waste-reduction predictions, energy savings, and environmental impact.

Progress and Milestones

- Akzo Nobel has already developed four low-temperature catalysts with promising selectivity and low CO_2 levels.
- Available engineering solutions have been identified to address the issues of flammability and heat transfer.
- Initial commercialization plans call for demonstrations by the year 2000, pilot tests by 2001, and commercial licensing by 2003.



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