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Methods of Preparation and use of Nickel-containing Molecular Sieve Catalysts for Olefin Oligomerization

A highly selective catalyst technology converts light alkenes from shale gas resources into high-value dimer products and transportation fuels, including premium gasoline and diesel, while minimizing unwanted side reactions.

In the US, there has been a rapid increase in the production of natural gas liquids such as ethane, propane, and butane. This abundance has led to increasing amounts of ethene production. With the wide availability of ethene, an opportunity exists to investigate alternate pathways to produce products using ethene as a reactant. Ethene dimerization produces butenes, which are involved in manufacturing premium blending stock for gasoline. Butenes can be oligomerized further to produce diesel fuel. In addition, ethene can also be converted to propene, in which the first step in ethene dimerization. Therefore, ethene dimerization or oligomerization provides potential in chemistry to form higher molecular weight compounds and transportation fuels. Current approaches do not allow selective dimerization and invoke unwanted skeletal isomerization and cracking side reactions. There is need of a method for correcting these undesired effects.

Researchers at Purdue University have developed a method of preparation of catalyst for upgrading light hydrocarbons from shale gas resources, a catalyst for alkene (olefin) oligomerization. This catalyst technology can selectively covert light alkenes into dimer products (e.g. ethene to butene), which can further be tuned to make heavier molecular weight oligomers. Unlike commercially-available zeolite catalysts, this catalyst allows for nearly 100 percent selective dimerization, while suppressing undesired skeletal isomerization and cracking side reactions. Various butene products could be produced using this technology including premium gasoline, diesel fuel, among other transportation fuels.

Advantages:

-High selectivity

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Category
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Chemicals & Advanced Materials/Green & Bio-Based Chemistry
Automotive & Mobility Tech/Fuel Injection & Combustion Control Systems

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-Suppressed side reactions

-Suppresses undesired skeletal isomerization

Potential Applications:

-Premium gasoline

-Diesel fuel

TRL: 4

Intellectual Property:

Provisional-Patent, 2017-08-01, United States | Provisional-Patent, 2017-08-15, United States | PCT-Patent, 2018-07-31, WO | NATL-Patent, 2020-01-31, United States | CIP-Patent, N/A, United States

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