UOP
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UOP Catalytic Condensation Process for Higher Olefins

Petrochemical

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Introduction

The UOP Catalytic Condensation process utilizes an acid catalyst to polymerize propylene for the production of nonene and propylene tetramer.

As first applied, the Catalytic Condensation process was utilized to make economic use of the light olefinic by-product gases derived from thermal processing by converting these materials to high octane motor fuel. This basic application was later extended to the processing of propylene and butylenes derived from fluid catalytic cracking operations.

The flexibility of the process is such that it is used commercially to produce a broad range of products. The process is used extensively to polymerize propylene and/or butylenes to produce C_7, C_9 and C_{12} olefins. These higher molecular weight olefins are used as building blocks in the production of a number of intermediate materials and end products such as specialty alcohols, detergents and plastics.

The UOP Catalytic Condensation process using solid phosphoric acid catalyst enjoys a dominant position around the world for polymerization of olefinic feedstocks; a position which is justified by its engineering design, product distribution, and overall economy of operation.

Applications

The UOP Catalytic Condensation process areas of application include the condensation of light olefins to form nonene, propylene tetramer, and gasoline boiling range products.

UOP's solid phosphoric acid (SPA) catalyst is non-corrosive, which permits the extensive use of carbon steel fabrication throughout the unit for major equipment and piping.

Description

The high-pressure units for olefin polymerization utilize either a tubular or a chamber-type reactor design. The UOP tubular-type reactor contains the catalyst in tubes. The tubes are surrounded by a water jacket for the purpose of removing the heat liberated by the exothermic reaction. The steam generated in the water jacket can be used to preheat the feed.

In the chamber-type reactor the catalyst is contained in a series of separate beds of varying thicknesses. Temperature control is accomplished by recycling spent propane and/or butane as feed diluent and as a quench which is introduced between the catalyst beds. The tubular-type reactor provides a somewhat more efficient temperature moderation system which permits a higher olefin concentration in the combined reactor feed. For a given operation, less catalyst is required and utility requirements are reduced. In general, chamber reactors are less expensive to install. UOP has tended to standardize on the chamber design.

There are number of potential process designs and modes of operation which are available, the selection of which is dependent on the specific situation.

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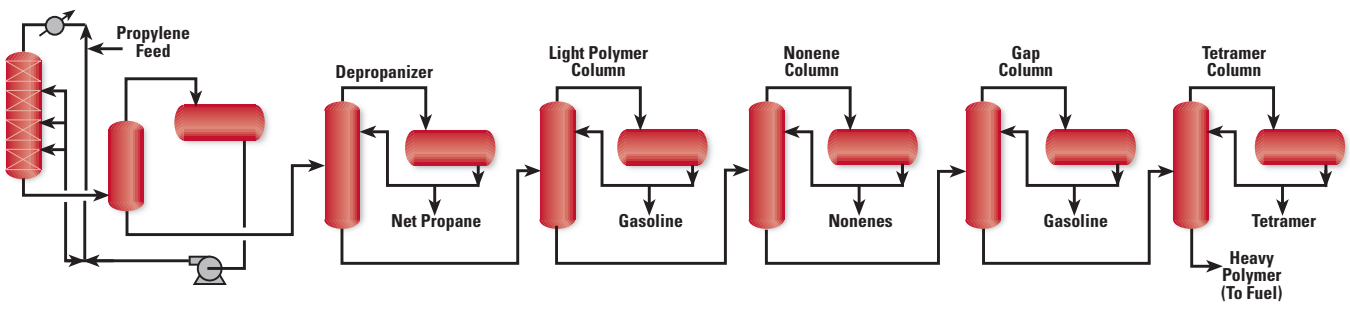


As applied to nonene and propylene tetramer production, the design and operation of the UOP Catalytic Condensation unit is simple and straightforward. Propylene-containing streams derived from FCC or thermal operations are processed. The feed stream is generally treated for removal of nitrogen and sulfur compounds and is directed to a combined feed surge drum. Feed diluent (“spent” propane), is recycled to the surge drum. Combined feed is preheated and charged to the reactor. Control or moderation of the heat release in the reactor is accomplished both by feed dilution and by quenching between the catalyst beds in the reactor. Reactor effluent is directed to a flash drum. The flash vapor is condensed and the condensate cooled. Some of the condensate is recycled for use as feed diluent and quench. Flash drum liquid flows to a stabilizer where C_6+ material is withdrawn as a bottoms product. Spent C_3 is recovered overhead in the stabilizer and directed to offsite storage.

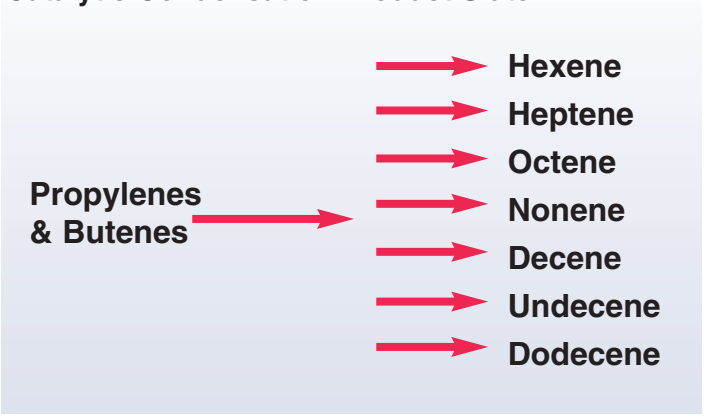
Products

The mono-olefin content of poly unit heptenes and nonenes is usually greater than 99 percent by weight. Due to the relatively narrow boiling ranges of these cuts, they are essentially single carbon number products. Tetramer has a somewhat lower mono-olefin content, usually in the range of 95-97 weight percent; the C_{12} content is approximately 70-75 volume percent.

Commercial Experience

Since first commercialization of the process in 1935, UOP has licensed and designed over 250 units for production of poly gasoline and petrochemical olefins, including approximately 30 units for production of nonene/tetramer.

Catalytic Condensation Product Slate



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