

# FCC C4 SHU

## PURPOSE

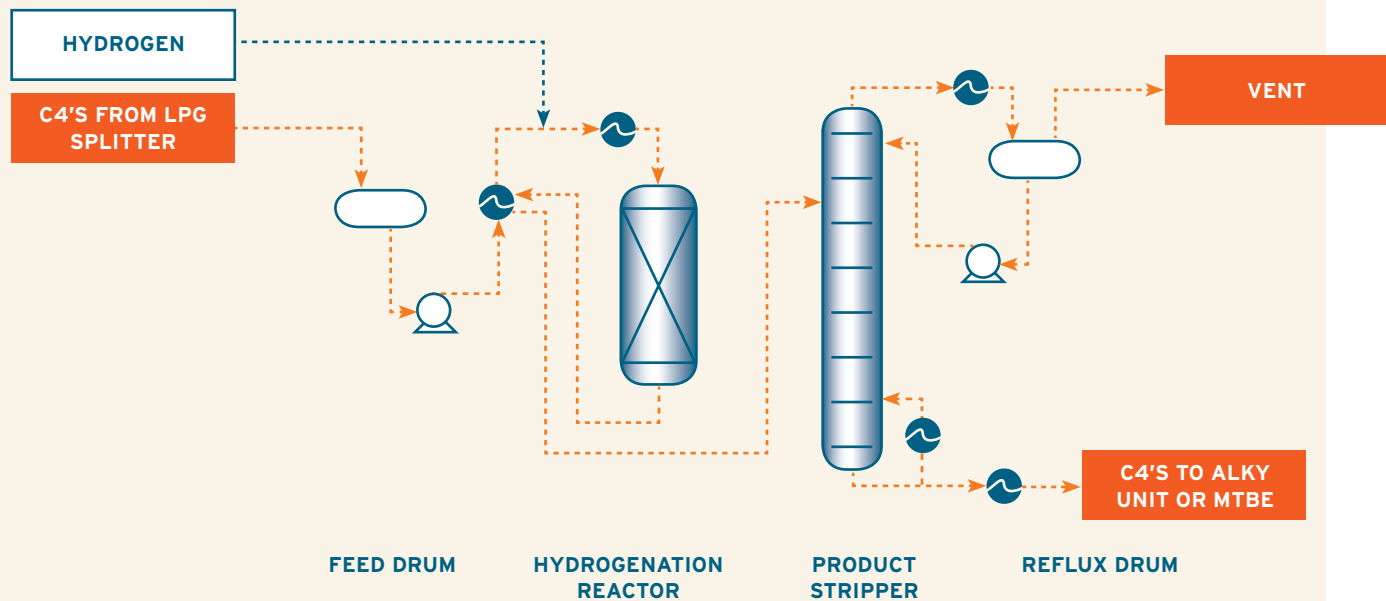
Diolefins and mercaptans are contaminants to all alkylation and dimerization processes. Eliminating 1,3 butadiene from this butenes-rich C4 stream can produce a number of important benefits, including reductions in:

- acid consumption in alkylation;
- catalyst fouling in dimerization;
- product gum concentration; and
- energy required for redistillation of the product.

## DESCRIPTION

A C4-rich hydrocarbon enters the feed drum from the bottom of the LPG splitter. The feed is then pumped to 300 - 450 psig; mixed with hydrogen; heated; and introduced to the reactor. Hydrogen flow is regulated in proportion to the hydrocarbon feed rate.

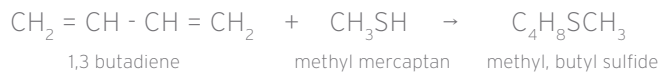
The purified product exits the reactor; is cooled; and then enters the product stripper. Unreacted hydrogen and light hydrocarbons are vented back to the Wet Gas Compressor. The stabilized product is cooled prior to being routed to storage, or to alkylation or dimerization units.



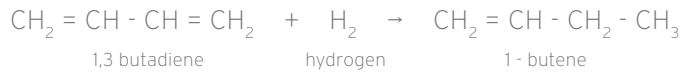
## THE FOLLOWING REACTIONS TAKE PLACE ACROSS THE CATALYST BED:

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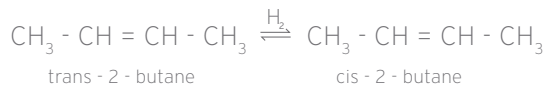
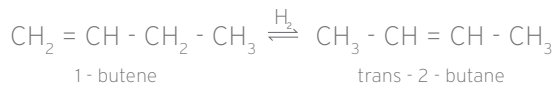
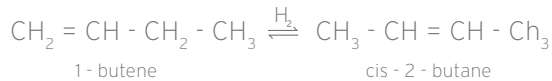
**Thioetherification** – converting mercaptans to sulfides.



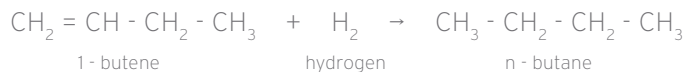
**Selective hydrogenation** – converting 1,3 butadiene to 1-butene.



**Hydroisomerization** – converting 1-butene to cis-2-butene and trans-2-butene



**Saturation** – converting butenes to n-butane.



Both the choice of catalyst and the process conditions determine the extent of the reaction – whether it's thioetherification, selective hydrogenation, hydroisomerization, or olefin saturation.

### CATALYST PERFORMANCE METRICS

Conversion of 1,3 butadiene is the most important function of the catalyst. High conversion requires a combination of **activity** and **selectivity**.

**ACTIVITY** is gauged by the consumption of hydrogen at a given LHSV (liquid hourly space velocity – the inverse of residence time) and temperature. Ideal activity achieves high consumption at high LHSV at low temperature. Certain contaminants in the feed can adversely affect this outcome. A catalyst must be designed to overcome the inhibiting effects of the contaminants. Catalyst activity also determines how much unreacted hydrogen remains in the reactor effluent.

**SELECTIVITY** compares the relative amount of butene saturated to the amount of butadiene converted. Because selectivity is a fundamental characteristic of the catalyst, selectivity becomes the focus of much design work. Without adjusting selectivity, all the hydrogen could be consumed before all of the butadiene reacts. Selectivity also determines factors such as: the amount of hydrogen required to meet the product specification; how much butene is converted to butane while achieving the required butadiene specification; and the temperature rise in the reactor.

An additional function of this process is hydroisomerization of 1-butene to form trans-2-butene. This is achieved by manipulation of process conditions. However, catalyst design can also be used to alter the relative rates of hydroisomerization versus olefin saturation.