UOP
A Honeywell Company

Lummus/UOP Smart SM™ Process

Petrochemical

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Introduction

The Lummus/UOP Smart SM process combines oxidative reheat technology with adiabatic dehydrogenation technology to produce styrene monomer (SM) from ethylbenzene. It uses specially designed UOP reactors to achieve the oxidation and dehydrogenation reactions.

In the oxidative reheat section of the reactor, hydrogen is oxidized to supply the heat for the dehydrogenation reactions. This eliminates the costly interstage reheater and reduces superheated steam requirements. As hydrogen is consumed in the oxidation step, the dehydrogenation reaction equilibrium is shifted forward through the reduction in hydrogen partial pressure. This results in EB conversion of more than 80%. For existing SM producers, revamping to the Smart SM process is a cost-effective route to increased capacity.

The Lummus/UOP Smart SM process features:

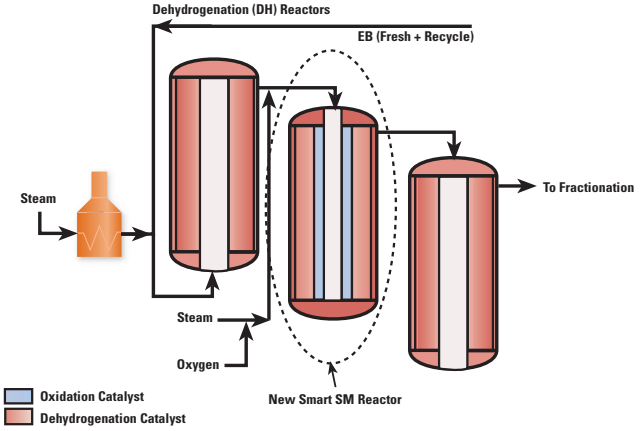
- Styrene monomer purity of 99.85 wt-% minimum
- High per pass EB conversion (over 80%) for increased throughput
- Reduced superheated steam requirements
- No interstage heater

To provide the increased EB requirements of a revamped SM unit, UOP also offers the Lummus/UOP EBOne™ process for AlCl3 ethylbenzene (EB) units. This commercially proven process uses the EBZ-500™ zeolitic catalyst to provide significantly lower production cost. Revamping your complex using the Lummus/UOP Smart SM process combined with the Lummus/UOP EBOne process provides the most cost-effective option for increasing capacity and improving the profitability of your styrene complex.

Description

The feedstock, ethylbenzene, is catalytically dehydrogenated to styrene in the presence of steam in a fixed-bed, radial flow reactor system. The dehydrogenation reaction is favored by low pressures and is generally conducted under deep vacuum. Endothermic heat of reaction in the Smart SM reactor is supplied by oxidative reheat through the combustion of hydrogen with a stream of oxygen. Toluene, benzene, and some light compounds are formed as by-products. Reactor effluent waste heat is recovered through heat exchange with combined feed, and by generating steam utilized in the process. The off gas stream is compressed, processed through the off gas recovery section, and used as fuel in the steam superheater. The condensates from the condenser and off gas recovery section flow into the separator, where hydrocarbon and water phases separate. The dehydrogenated mixture is fractionated to recover the styrene monomer product, recycle ethylbenzene, and benzene and toluene byproducts. Inhibitors are added to prevent styrene polymerization in the process equipment.

Typical Smart SM Revamp



Feedstock and product

Feedstock

Ethylbenzene	99.85 wt-% min
Xylene	50 ppm wt-% max
Diethylbenzene	8 ppm wt-% max

Styrene Product

Styrene	99.85 wt-% min
Ethylbenzene	0.03 wt-% max
Alpha-methylstyrene	0.03 wt-% max

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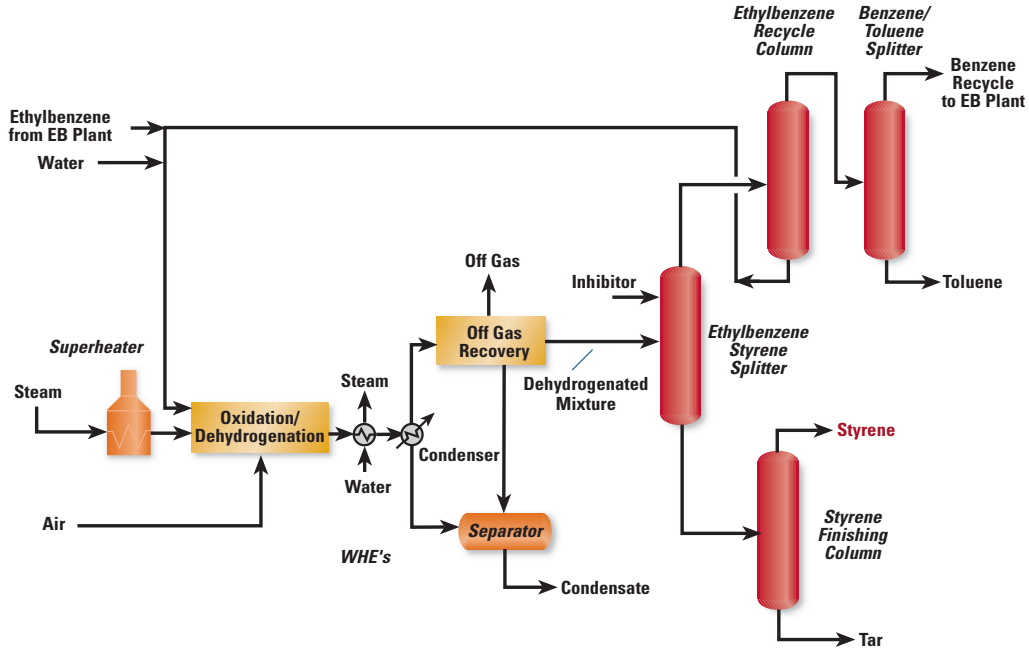

Commercial experience

Since the introduction of the Lummus/UOP Smart SM process in 1995, Lummus and UOP have been awarded 5 projects with styrene capacities ranging from 84,000 to 427,000 MTA. Five commercial plants are in operation worldwide having a total styrene capacity of more than 1,300,000 MTA.

For more information

Lummus/UOP Smart SM technological services are available on request. For more information, contact your local UOP representative or our Des Plaines sales office:

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