Question 30: What is the recommended feed nozzle design for HF alkylation units to provide proper mixing of the feed, HF acid, and isobutane? What are the recommended materials of construction for these nozzles?

Michael Windham (UOP)

The licensor for HF alkylation is UOP and they should be consulted before changing the feed nozzles. Isothermal reactors that have feed injection in the reactor bundle utilize a feed pipe system with nozzles machined into the pipes. These pipes are carbon steel. Gravity circulation HF alkylation units use hollow cone spray nozzles that are attached to a matrix of small feed pipes that spray into the flowing acid in the riser reactor. These nozzles are Monel or Kynar attached to carbon steel piping. The size, number, and pressure drop across the nozzles are design factors that a set to meet design criteria for the unit.

Brad Palmer (ConocoPhillips)

The combined feed (olefin and make-up) and recycle isobutane are mixed using a static mixer prior to entering the reactor. Additional mixing is achieved using spray nozzles or an inlet pipe distributor. The choice is dependent on which reactor design is used. The combined feed of the gravity circulation reactor is injected through a tube sheet at the bottom of the reactor, passing through a series of dispersion pipes fitted with Alloy 400 spray nozzles. The purpose of the spray nozzles are to minimize the droplet size of the hydrocarbon feed by controlling the pressure drop across the nozzles and to ensure thorough dispersion of the hydrocarbon into the acid phase. The same effect is achieved with the forced circulation reactor design with an inlet distributor installed in the reaction zone. Each distributor has a series of holes or beveled cuts to enhance the spray pattern and promote mixing. The distributor metallurgy is Carbon Steel.

Erik Myers (Valero)

It varies depending on the licensor design. The most important aspect is maintaining a good pressure drop to give proper mixing. Consult the licensor to determine the correct pressure drop and block in/ open up nozzles to achieve the desired pressure drop.

Nozzle metallurgy is typically a licensor recommendation. We gave used Monel, carbon steel and Hastelloy at our sites.

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Reactor Vessel

Year

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