Polyethylene & Polypropylene Loop Reactor Measurements Using Radiometric Measurement Technology

The Loop Reactor are used to convert monomers into polymers in the presence of catalyst. The mixing of feedstock, diluent, hydrogen and catalysts occur here to make the desired product, polyethylene or polypropylene, as shown in “Figure 1.” As an exothermic reaction, cooling jackets are used in portions of the vessel to remove excess heat. With piping typically 24-28 inches, VEGA uses an externally mounted source and MT31 detector to measure the density inside the pipe.

As the polymer forms inside the reactor loop, so too will the density of the mixture increase, so that the concentration and efficiency of the reactor operation can be measured. There are two variables changing in the measurement. The first is solvent/diluent temperature, and the second is the amount of polymer solids being generated in the process reaction.

This can be seen in the output of the MT31 detector and verified by seeing an increase in the amperage of the axial pump used to circulate the mixture as it is now a heavier loop volume. Operators wish to maintain as high as possible density, but if the polymer forms too fast or excessively, the pipe will plug. The average calibrated density range is 375kg/m3 to 700kg/m3, with the desired measurement span being set by expected polymer production & operating conditions.

One challenge is that process temperature may change, and the operator may not know if any change in density is from polymer formation or temperature change. The transmitter can supply the density value to the DCS, and the DCS can calculate a % solids value based on calculated solvent density at operating temperature.

Calibration of radiometric measurements is also key to ensuring an accurate and reliable measurement of process material density. In applications such as a loop reactor, where process material sampling is not feasible, we must employ material density references as allowed by the reactor operation. VEGA can help to correctly specify equipment for measurement for the Loop reactor material density & provide insight on calibration strategies for an accurate and reliable measurement.

If you have any inquiries about how VEGA’s MiniTrac31 can be used to help control polymer production in loop reactor systems, please contact an application engineer or sales associate.

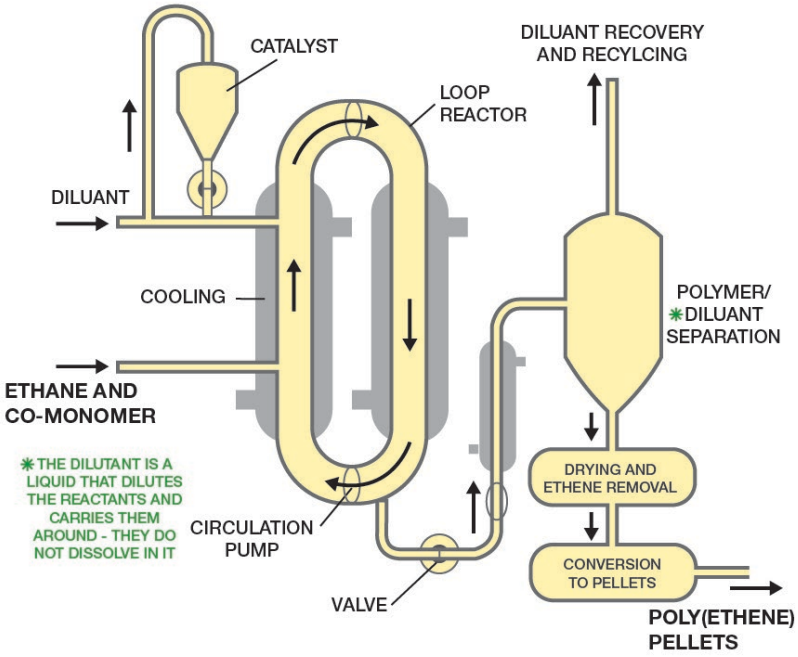

Figure 1: Typical Process with Loop Reactor