

CHEMICAL MANUFACTURER ACHIEVES IMPROVED CYCLE TIMES ON BATCH PROCESS

A specialty chemical manufacturer makes a number of products that require high (550 deg. F) reaction temperatures. The manufacturer heats and cools a 6000 gal. reactor with a petroleum based heat transfer fluid. The heat transfer was accomplished through a four zone half-pipe jacket on the reactor.

PROBLEM STATEMENT

The owner had excess thermal fluid heater capacity and wanted to improve batch cycle times. Problems associated with reducing the heating and cooling times included the fact that the petroleum based heat transfer fluid was operating near its published maximum temperature and could not be operated very much hotter. It was also determined through trials that simply increasing the heat transfer fluid temperature could cause quality problems (color degradation) of the product related to a “hot spot” on the wall of the reactor at the jacket inlet locations. Problems with batch cooling times resulted from the increase in viscosity of the fluid at low temperatures reducing flow through the jacket at lower heat transfer fluid temperatures.

CORRECTIVE MEASURES

1. A product circulating pump and side arm heat exchanger was specified and installed. The reactor contents are circulated through this H/E during most of the reaction cycle. The H/E is heated and cooled on the shell side by the heat transfer fluid.
2. When the heat transfer fluid was scheduled for a change out, it was replaced with a product that exhibited a lower viscosity at lower temperatures.

IMPROVEMENTS NOTED

1. Heat transfer area was effectively doubled and, due to the rapid circulation rate in the H/E, batch heats up times were cut by approximately 55%.
2. The replacement heat transfer fluid allowed improved flow and Reynolds numbers resulting in improved heat transfer efficiency and allowed cooling the batch to manageable temperatures (for packaging) approximately 30% faster.
3. The improvements reduced batch cycle time and improved equipment utilization and also improved product quality by reducing the heat history of the batch.