LIQUID-LIQUID SEPARATOR INTERFACE DETECTION SYSTEM AND POLYMERIZATION PROCESS UTILIZING THE SAME

Field of Invention

The instant invention relates to a liquid-liquid separator interface detection system and polymerization process utilizing same.

Background of the Invention

Liquid-liquid separators are used in a variety of applications to separate two liquid phases having different densities. Liquid–liquid separators may be used to separate the solvent and polymer in the Solution Polyolefin process. For the stability of a solution, it is very important to control the interface layer (the rag layer) between the polymer solution and pure solvent. The location of this layer determines the degree of separation between the two liquids. Unfortunately, the separator does not contain any side glass to view the interface and a sonic probe was used to detect the polymer and solvent interface in the carbon steel vessel.

Summary ~~of the Invention~~

The instant ~~invention~~ disclosure is a liquid-liquid separator interface detection system and polymerization process utilizing same.

In one embodiment, the instant disclosure~~invention~~ provides a system for detecting an interface between a polymer-rich phase and a solvent-rich phase comprising a liquid-liquid separator (LLS) configured to receive an inlet stream comprising solvent, polymer and unreacted monomer produced in a solvent-based polymerization reactor through an inlet feed, wherein the tank is configured to provide a residence time of at least 20 minutes and to permit the stream to separate into a polymer rich phase and a solvent rich phase; a first sonic transponder for sending a first sonic signal from either a top or bottom of the liquid-liquid separator and for receiving a first reflected portion of the sonic signal, the reflected portion of the sonic signal created by the passage of the sonic signal through a liquid-liquid interface between the solvent rich phase and the polymer rich phase, wherein the first sonic transponder is positioned such that it transmits a signal with travels perpendicularly to the liquid-liquid interface.

In an aspect, the instant disclosure provides a polymerization process comprising: A) polymerizing one or more monomers in the presence of a solvent, to form a polymer solution; B) transferring the polymer solution to a liquid-liquid separator, without adding heat to the solution, and wherein a pressure of the polymer solution is actively reduced in a controlled manner prior to, or within, the liquid-liquid separator, to induce at least two liquid phases, a polymer-rich phase and a solvent-rich phase, and wherein a concentration of polymer in the polymer-rich phase is higher than that in the polymer solution transferred to the liquid-liquid separator; and C) detecting an interface between the polymer-rich phase and the solvent-rich phase by use of two sonic transponders positioned within the liquid-liquid separator; such that a first sonic transponder is located in a bottom half of the liquid-liquid separator; and D) removing the solvent-rich phase from the liquid-liquid separator and the removed solvent-rich phase comprises less than 1000 ppm polymer.

AMENDED CLAIMS
received by the International Bureau on 19 August 2013 (19.08.2013)

1. A system for detecting an interface between a polymer-rich phase and a solvent-rich phase comprising:

a liquid-liquid separator configured to receive an inlet stream comprising solvent, polymer and monomer produced in a solvent-based polymerization reactor through an inlet feed, wherein the tank is configured to provide a residence time of at least 20 minutes and to permit the stream to separate into the polymer rich phase and the solvent rich phase;

a first sonic transponder for sending a first sonic signal from either a top or bottom of the liquid-liquid separator and for receiving a first reflected portion of the sonic signal, the reflected portion of the sonic signal created by the passage of the sonic signal through a liquid-liquid interface between the solvent rich phase and the polymer rich phase, wherein the first sonic transponder is positioned such that it transmits a signal with travels perpendicularly to the liquid-liquid interface, wherein the inlet feed feeds the stream into a bottom portion of the liquid-liquid separator.

2. The system according to claim 1, further comprising a sleeve partially or wholly enclosing the first sonic transponder.

4. The system according to any one of the preceding claims, wherein the liquid-liquid separator is jacketed.

5. The system according to any one of the preceding claims, wherein the liquid-liquid separator is a gravity separator.

6. The system according to any one of the preceding claims, further comprising a polymer rich phase outlet valve comprising a flow meter and a differential pressure transmitter located on either side of the flow meter.

7. The system according to any one of the preceding claims, further comprising an automated control valve to control the level of polymer rich phase in the liquid-liquid separator.

8. The system according to any one of the preceding claims, further comprising a second sonic transponder for sending a second sonic signal from either a top or bottom of the liquid-liquid separator and for receiving a second reflected portion of the sonic signal.

Claims:

~~9. The system according to any one of the preceding claims, further comprising a control system to receive and analyze data recovered from the first, and optionally from the second, sonic transponders.~~

1~~0~~. A polymerization process comprising: A) polymerizing one or more monomers in the presence of a solvent, to form a polymer solution; B) transferring the polymer solution to a liquid-liquid separator, without adding heat to the solution, and wherein a pressure of the polymer solution is actively reduced in a controlled manner prior to, or within, the liquid-liquid separator, to induce at least two liquid phases, a polymer-rich phase and a solvent-rich phase, and wherein a concentration of polymer in the polymer-rich phase is higher than that in the polymer solution transferred to the liquid-liquid separator; and C) detecting an interface between the polymer-rich phase and the solvent-rich phase by use of two~~a~~ sonic transponder~~s~~ positioned within the liquid-liquid separator; such that a first sonic transponder is located in a bottom half of the liquid-liquid separator; and D) removing ~~one or both of~~ the solvent-rich phase from the liquid-liquid separator~~and the polymer-rich phase~~ and the removed solvent-rich phase comprises less than 1000 ppm polymer.

~~11. The polymerization process according to claim 10, wherein the solvent-rich phase is removed from the liquid-liquid separator and the removed solvent-rich phase comprises less than 1000 ppm polymer.~~

~~maintained at a temperature greater than, or equal to, 150 °C.~~

2~~12~~. The polymerization process according to ~~any one of~~ claim~~s~~ 1~~10-11~~, wherein step (A) occurs in a solution polymerization reactor.

3~~13~~. The polymerization process according to ~~any one of~~ claim~~s~~ 1~~10-12~~, wherein step (A) occurs in a continuously stirred tank reactor.

4~~14~~. The polymerization process according to ~~any one of~~ claim~~s~~ 1~~10-13~~, further comprising calculating a vertical position of the interface face from a reflected sonic signal received by the sonic transponder.

5~~15~~. The polymerization process according to ~~any one of~~ claim~~s~~ 1~~10-14~~, further comprising adjusting a flow rate of removing ~~one or both of~~ the solvent-rich phase~~and the polymer-rich phases~~ based upon the vertical position of the interface.