CLAIMS

1. A method for predicting a concentration of conjunct polymer in a spent ionic liquid of unknown conjunct polymer concentration, during a continuous hydrocarbon conversion process, the method comprising:

(a) contacting a hydrocarbon feed with an ionic liquid in a hydrocarbon conversion reaction zone under hydrocarbon conversion conditions to form a mixture comprising reaction products and spent ionic liquid containing conjunct polymer;

(b) acquiring an infrared spectrum for each of a plurality of samples of the mixture in (a) using an in-line infrared spectrometer configured with a measurement flow cell to allow the spent ionic liquid to flow therethrough, wherein absorbance values indicative of conjunct polymer are measured in each infrared spectrum over a wavenumber range of from 800 cm^{-1} to 1800 cm^{-1};

(c) collecting a sample from the mixture in (a) at each of a plurality of corresponding time points during the continuous hydrocarbon conversion process and separately determining off-line a concentration of conjunct polymer in the spent ionic liquid by acquiring a corresponding infrared spectrum for each sample using an off-line infrared spectrometer, wherein absorbance values indicative of conjunct polymer are measured in each infrared spectrum over a wavenumber range of from 800 cm^{-1} to 1800 cm^{-1};

(d) analyzing the infrared spectra acquired in (b) and (c) using a multivariate chemometric technique to provide a training data set, wherein the multivariate chemometric technique comprises a partial least squares (PLS) analysis;

(e) generating a predictive model for conjunct polymer concentration based on the training data set, wherein the predictive model is established using partial component analysis (PCA);

(f) applying the predictive model to the infrared spectra acquired in (b); and thereafter

(g) quantitatively predicting the conjunct polymer concentration in the spent ionic liquid during the continuous hydrocarbon conversion process.

2. The method of claim 1, wherein the hydrocarbon conversion process comprises at least one of alkylation, disproportionation, isomerization, and oligomerization.

3. The method of claim 2, wherein alkylation comprises contacting an isoparaffin feed having from 4 to 10 carbon atoms and an olefin feed having from 2 to 10 carbon atoms in the presence of an ionic liquid in an alkylation zone under alkylation conditions to generate an alkylate.

4. The method of claim 1, wherein acquiring the infrared spectrum in (b) and/or (c) comprises acquiring an attenuated total reflectance Fourier transform infrared spectrum.

5. The method of claim 1, further comprising:
controlling at least one of the following based upon the predicted conjunct polymer concentration in (g):

(i) an amount of spent ionic liquid passed back to the reaction zone;

(ii) an amount of spent ionic liquid passed to a regeneration zone;

(iii) an amount of regenerated ionic liquid passed back to the reaction zone;

(iv) an amount of fresh ionic liquid passed to the reaction zone; and

(v) an amount of spent ionic liquid catalyst removed from the continuous hydrocarbon conversion process.

6. The method of claim 1, further comprising:
maintaining a desired concentration range of conjunct polymer in the spent ionic liquid.

7. The method of claim 1, further comprising:
lowering a portion of spent ionic liquid returned to the reaction zone if a concentration of conjunct polymer in the spent ionic liquid is above a desired range.

8. The method of claim 6, further comprising:
passing a fresh ionic liquid, a regenerated ionic liquid, or both to the reaction zone if the concentration of conjunct polymer in the spent ionic liquid is above the desired range.

9. The method of claim 1, wherein the predicting of the concentration of conjunct polymer in the spent ionic liquid during the continuous hydrocarbon conversion process is performed in real-time or near real-time.

10. The method of claim 1, wherein in (c), at least 50 samples are collected.

11. The method of claim 1, wherein the spent ionic liquid containing conjunct polymer has a concentration of conjunct polymer that ranges from 50 ppm to 7% by weight conjunct polymer.