CLAIMS

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

(a) ~~separating an effluent from a reaction zone into a light fraction and a heavy fraction, the heavy fraction comprising spent ionic liquid of unknown conjunct polymer concentration~~ 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 ~~spent ionic liquid~~ 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~~n~~ corresponding infrared spectrum for each sample~~of a plurality of samples~~ 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, further comprising:~~

~~contacting a hydrocarbon feed with an ionic liquid in a reaction zone under hydrocarbon conversion conditions to form the effluent.~~

2~~3~~. The method of claim 1, wherein the hydrocarbon conversion process comprises at least one of alkylation, disproportionation, isomerization, and oligomerization.

4~~3~~. The method of claim ~~3~~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.

5~~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.

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

~~8~~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.

~~9~~8. The method of claim ~~7~~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.

~~10. The method of claim 1, wherein the multivariate chemometric technique of (b) comprises a partial least squares (PLS) analysis.~~

~~11. The method of claim 1, wherein (b) and (c) utilize portions of the infrared spectrum comprising a range of from 1300 cm^{-1} to 1400 cm^{-1}.~~

~~12~~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.