We Claim:

1. A method for the production of vinyl acetate, said method comprising:

(a) reacting

(i) 65 to 80 mol. % of ethylene,

(ii) 10 to 25 mol. % of acetic acid, and

(iii) 5 to 15 mol. % of an oxygen-containing gas in the presence of a catalyst in a reactor to produce vinyl acetate;

(b) withdrawing from the reactor a gas stream comprising ethylene, acetic acid, vinyl acetate, water, and carbon dioxide;

(c) separating the gas stream into an ethylene stream comprising ethylene and carbon dioxide, and a primary vinyl acetate product stream comprising vinyl acetate, water, and acetic acid;

(d) separating the ethylene stream into a recovered ethylene stream and a carbon dioxide stream;

(e) separating the primary vinyl acetate product stream into a vinyl acetate product stream and a recovered acetic acid stream;

(f) recycling the recovered ethylene stream of step (d) and the recovered acetic acid stream of step (e) to the reactor in step (a);

(g) measuring the concentration of a component involved in or associated with one or more of the above steps by Raman spectroscopic analysis wherein the measuring step includes the step of identifying the Raman shifts and intensity of the component involved in or associated with one or more of the above steps; and

(h) adjusting the conditions in the reactor or in any of the subsequent steps in response to the measured concentration of the component to achieve a proper control of the reaction or any of the subsequent steps.

2. The method of claim 1, wherein the catalyst is a palladium-gold catalyst.

3. The method of claim 1, wherein the separation of the gas stream in step (c) is performed in an absorber tower in which vinyl acetate is absorbed by an acetic acid aqueous solution to form the primary vinyl acetate product stream.

4. The method of claim 1, wherein the separation of the primary vinyl acetate product stream in step (e) is performed in a primary distillation tower.

5. The method of claim 1, wherein the component measured by Raman spectroscopy is selected from the group consisting of water, oxygen, vinyl acetate, acetic acid, carbon dioxide, ethylene, ethanol, methyl acetate, ethyl acetate, glycol diacetate, polyvinyl acetate, acetaldehyde, acetone, acrolein, polymerization inhibitor, potassium carbonate, potassium bicarbonate, potassium acetate, potassium hydroxide, and mixtures thereof.

6. The method of claim 1, wherein the component measured by Raman spectroscopy is selected from the group consisting of acetic acid, vinyl acetate, carbon dioxide, water, ethylene, and mixtures thereof.

7. The method of claim 6, wherein the measurement is performed in the reactor liquid phase.

8. The method of claim 6, wherein the measurement is performed in the reactor gas phase.

9. The method of claim 1, wherein the adjusting is accomplished by adding or removing a component from the reactor, from any subsequent steps, or from both.

10. The method of claim 1 wherein the adjusting is accomplished by changing a temperature profile in the reactor, in any of the subsequent steps, or in both.

We Claim:

1. A method for the production of vinyl acetate, said method comprising:

(a) reacting

(i) 65 to 80 mol. % of ethylene based on the combined feed,

(ii) 10 to 25 mol. % of acetic acid based on the combined feed, and

(iii) 5 to 15 mol. % of oxygen based on the combined feed in the presence of a palladium gold catalyst in a reactor to produce vinyl acetate;

(b) withdrawing from the reactor a gas stream comprising ethylene, acetic acid, vinyl acetate, water, and carbon dioxide;

(c) separating the gas stream into an ethylene stream comprising ethylene and carbon dioxide, and a primary vinyl acetate product stream comprising vinyl acetate, water, and acetic acid;

(d) separating the ethylene stream into a recovered ethylene stream and a carbon dioxide stream;

(e) separating the primary vinyl acetate product stream into a vinyl acetate product stream and a recovered acetic acid stream;

(f) recycling the recovered ethylene stream of step (d) and the recovered acetic acid stream of step (e) to the reactor in step (a);

(g) measuring the concentration of a component involved in or associated with one or more of the above steps by Raman spectroscopic analysis wherein the measuring step includes the step of identifying the Raman shifts and intensity of the component involved in or associated with one or more of the above steps; and

(h) adjusting the conditions in the reactor or in any of the subsequent steps in response to the measured concentration of the component to achieve a proper control of the reaction or any of the subsequent steps.

2. The method of claim 1, wherein the separation of the gas stream in step (c) is performed in an absorber tower in which vinyl acetate is absorbed by an acetic acid aqueous solution to form the primary vinyl acetate product stream.

3. The method of claim 1, wherein the separation of the primary vinyl acetate product stream in step (e) is performed in a primary distillation tower.

4. The method of claim 1, wherein the component measured by Raman spectroscopy is selected from the group consisting of water, oxygen, vinyl acetate, acetic acid, carbon dioxide, ethylene, ethanol, methyl acetate, ethyl acetate, glycol diacetate, polyvinyl acetate, acetaldehyde, acetone, acrolein, polymerization inhibitor, potassium carbonate, potassium bicarbonate, potassium acetate, potassium hydroxide, and mixtures thereof.

5. The method of claim 1, wherein the component measured by Raman spectroscopy is selected from the group consisting of acetic acid, vinyl acetate, carbon dioxide, water, ethylene, and mixtures thereof.

6. The method of claim 5, wherein the measurement is performed in the reactor liquid phase.

7. The method of claim 5, wherein the measurement is performed in the reactor gas phase.

8. The method of claim 1, wherein the adjusting is accomplished by adding or removing a component from the reactor, from any subsequent steps, or from both.

9. The method of claim 1 wherein the adjusting is accomplished by changing a temperature profile in the reactor, in any of the subsequent steps, or in both.