CLAIMS:

1. A process for the production of acetic acid, comprising:

oxidizing ethane in a first reactor to produce a first effluent stream comprising acetic acid and ethylene; and

oxidizing the first effluent stream in a second reactor at conditions sufficient to oxidize at least some ethylene.

2. The process of claim 1, wherein the oxidizing ethane occurs at about 400 °C to about 600 °C.

3. The process of claim 1, wherein the oxidizing the first effluent stream in a second reactor occurs at about 150 °C to about 250 °C.

4. The process of claim 1, wherein the oxidizing ethane and oxidizing the first effluent stream is performed with a catalyst having the chemical formula $Mo_1V_{0.55}Nb_{0.09}Sb_{0.01}Ca_{0.01}Pd_{0.00075}$.

5. The process of claim 1, wherein the oxidizing ethane is performed using a fixed bed reactor or a fluidized bed reactor.

6. The process of claim 1, wherein the oxidizing the first effluent stream is performed using a fixed bed or a fluidized bed reactor.

7. The process of claim 1, wherein the conditions of the oxidizing the first effluent stream are not sufficient to substantially oxidize ethane.

8. The process of claim 1, further comprising using a carrier gas for oxidizing ethane or oxidizing ethylene and the carrier gas is selected from the group consisting of nitrogen, methane, carbon monoxide, carbon dioxide, air, steam, or combinations thereof.

9. The process of claim 1, wherein a solvent is used for oxidizing ethane or oxidizing ethylene and the solvent is selected from the group consisting of methanol, ethanol, propanol, diols, water, distilled water, and deionized water, and combinations thereof.

10. A process for the production of acetic acid, comprising:

oxidizing ethane in a first reactor to produce a first effluent stream comprising acetic acid and ethylene;

oxidizing the first effluent stream in a second reactor at conditions sufficient to oxidize at least some ethylene to produce a second effluent stream; and

flowing the second effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream.

11. The process of claim 10, further comprising a flowing the recycle stream through a CO_x scrubber.

12. The process of claim 10, wherein the first reactor is a fixed bed or fluidized bed reactor.

13. The process of claim 10, wherein the second reactor is a fixed bed or a fluidized bed reactor.

14. The process of claim 10, wherein the first reactor is at a temperature of about 400 °C to about 600 °C and the second reactor is at a temperature of about 150 °C to about 250 °C.

15. A process for the production of acetic acid, comprising:

oxidizing ethane in a first reactor to produce a first effluent stream comprising acetic acid and ethylene;

flowing the first effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream; and

oxidizing the first effluent stream in a second reactor at conditions sufficient to oxidize at least some ethylene to produce a second effluent stream.

16. The process of claim 15, further comprising flowing the first effluent stream through a filter before the first effluent stream flows into the recycle gas scrubber.

17. The process of claim 15, further comprising a CO_x scrubber in the recycle stream.

18. The process of claim 15, wherein the first reactor is at a temperature of about 400 °C to about 600 °C and the second reactor is at a temperature of about 150 °C to about 250 °C.

19. A process for the production of acetic acid, comprising:

oxidizing ethane in a first reactor to produce a first effluent stream comprising acetic acid and ethylene;

flowing the first effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream;

flowing a portion of the recycle stream to the first reactor; and

oxidizing a second portion of the recycle stream in a second reactor at conditions sufficient to oxidize at least some ethylene to produce a second effluent stream,

wherein the second effluent stream and first effluent stream are combined before the first effluent stream flows through the recycle gas scrubber.

The invention claimed is:

1. A process for the production of acetic acid, comprising: oxidizing ethane in a first reactor at a first temperature to produce a first effluent stream comprising acetic acid and ethylene; and oxidizing the first effluent stream in a second reactor at a second temperature lower than said first temperature and low enough to selectively oxidize ethylene to acetic acid to thereby remove ethylene from the first effluent stream and increase the acetic acid content of the first effluent stream.

2. The process of claim 1, wherein the first temperature of the first reactor is from about 400° C. to about 600° C.

3. The process of claim 1, wherein oxidizing the first effluent stream in the second reactor at the second temperature occurs at from about 150° C. to about 250° C.

4. The process of claim 1, wherein oxidizing ethane and oxidizing the first effluent stream is performed with a catalyst having the chemical formula $Mo_1V_{0.55}Nb_{0.09}Sb_{0.01}Ca_{0.01}Pd_{0.00075}$.

5. The process of claim 1, wherein oxidizing ethane is performed using a fixed bed reactor or a fluidized bed reactor.

6. The process of claim 1, wherein oxidizing the first effluent stream is performed using a fixed bed or a fluidized bed reactor.

7. The process of claim 1, further comprising using a carrier gas for oxidizing ethane or oxidizing ethylene and the carrier gas is selected from the group consisting of nitrogen, methane, carbon monoxide, carbon dioxide, air, steam and combinations thereof.

8. The process of claim 1, wherein a solvent is used for oxidizing ethane or oxidizing ethylene and the solvent is selected from the group consisting of methanol, ethanol, propanol, diols, water, distilled water, and deionized water, and combinations thereof.

9. A process for the production of acetic acid, comprising: oxidizing ethane in a first reactor at a first temperature to produce a first effluent stream comprising acetic acid and ethylene; oxidizing the first effluent stream in a second reactor at a second temperature lower than said first temperature and low enough to selectively oxidize ethylene to acetic acid to thereby remove ethylene from the first effluent stream and produce a second effluent stream enriched in acetic acid as compared with the first effluent stream; and flowing the second effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream.

10. The process of claim 9, further comprising flowing the second effluent stream through a filter before it flows through the recycle gas scrubber.

11. The process of claim 9, further comprising a flowing the recycle stream through a CO_x scrubber.

12. The process of claim 9, wherein the first reactor is a fixed bed or fluidized bed reactor.

13. The process of claim 9, wherein the second reactor is a fixed bed or a fluidized bed reactor.

14. The process of claim 9, wherein the first temperature of the first reactor is from about 400° C. to about 600° C. and the second temperature of the second reactor is from about 150° C. to about 250° C.

15. A process for the production of acetic acid, comprising: oxidizing ethane in a first reactor at a first temperature to produce a first effluent stream comprising acetic acid and ethylene; flowing the first effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream; and oxidizing the recycle stream in a second reactor at a second temperature lower than said first temperature and low enough to selectively oxidize ethylene to acetic acid to thereby remove ethylene from the recycle stream and produce a second effluent stream enriched in acetic acid as compared with the recycle stream.

16. The process of claim **15**, further comprising flowing the first effluent stream through a filter before the first effluent stream flows into the recycle gas scrubber.

17. The process of claim **15**, further comprising a CO_x scrubber in the recycle stream.

18. The process of claim **15**, wherein the first temperature of the first reactor is from about 400° C. to about 600° C. and the second temperature of the second reactor from about 150° C. to about 250° C.

19. A process for the production of acetic acid, comprising: oxidizing ethane in a first reactor to produce a first effluent stream comprising acetic acid and ethylene; flowing the first effluent stream through a recycle gas scrubber to produce an acetic acid stream and a recycle stream; flowing a portion of the recycle stream to the first reactor; and oxidizing a second portion of the recycle stream in a second reactor at a temperature low enough to selectively oxidize ethylene to acetic acid to produce a second effluent stream, wherein the second effluent stream and first effluent stream are combined before the first effluent stream flows through the recycle gas scrubber.

20. The process of claim **1**, wherein the second temperature of the second reactor is low enough such that substantially no ethane present is oxidized in the second reactor.

21. The process of claim **9**, wherein the second temperature of the second reactor is low enough such that substantially no ethane present is oxidized in the second reactor.

22. The process of claim **15**, wherein the second temperature of the second reactor is low enough such that substantially no ethane present is oxidized in the second reactor.

23. The process of claim **19**, wherein the second temperature of the second reactor is low enough such that substantially no ethane present is oxidized in the second reactor.