What is claimed is:

1. A process comprising:

introducing a first feed stream comprising hydrogen gas and a carbon-containing gas comprising carbon dioxide and carbon monoxide into a reaction zone of a first reactor, wherein a volume ratio of carbon dioxide to carbon monoxide in the feed stream is from 0.25 to 1.5;

converting the first feed stream into a first product stream comprising C_2 to C_4 hydrocarbons in the reaction zone in the presence of a first catalyst, wherein the first product stream further comprises carbon dioxide;

removing water and C_4 and higher hydrocarbons from the first product stream to form a second feed stream;

converting the second feed stream into a second product stream comprising propionaldehyde in the presence of a second catalyst in a second reactor.

2. The process of claim 1, wherein the carbon dioxide from the first product stream exiting the second reactor is recycled to the first feed stream.

3. The process of any one of claims 1 or 2, further comprising recycling unreacted hydrogen and carbon monoxide to the first feed stream.

4. The process of any one of the preceding claims, wherein the second product stream further comprises butyraldehyde.

5. The process of any one of claims 1 to 3, wherein the step of removing water and C_4 hydrocarbons from the first product stream further comprises removing C_3 hydrocarbons from the first product stream.

6. The process of any one of the preceding claims, further comprising removing the propionaldehyde from the second product stream.

7. The process of any one of the preceding claims, further comprising removing any paraffins from the second product stream.

8. The process of any one of the preceding claims, further comprising converting the propionaldehyde to methyl methacrylate via oxidative esterification.

9. The process of any one of claims 1 to 8, wherein the reaction zone operates at a pressure of at least 20 bar.

10. The process of any one of claims 1 to 9, wherein the first catalyst comprises a mixed metal oxide catalyst or comprises a hybrid catalyst comprising a mixed metal oxide catalyst and a microporous catalyst component.

11. The process of claim 10, wherein the mixed metal oxide catalyst component comprises ZrO_2; or wherein the mixed metal oxide catalyst component comprises ZrO_2 and Ga_2O_3.

12. The process of any one of claims 10 to 11, wherein the microporous catalyst component is a molecular sieve having 8-MR pore openings.

13. The process of any one of claims 10 to 12, wherein the microporous catalyst component is a molecular sieve having a Chabazite (CHA) framework.

14. The process of any one of claims 10 to 13, wherein the microporous catalyst component is SAPO-34.

15. The process of any one of claims 1 to 14, wherein the C_2 to C_4 hydrocarbons consist essentially of C_2 to C_4 olefins.