C L A I M S

1. A process for producing olefins, comprising:

a. providing a feed comprising at least methane, ethane and carbon dioxide;

b. separating the feed into at least a methane-comprising feed, an ethane-comprising feed and a carbon dioxide-comprising feed;

c. providing at least part of the methane-comprising feed to a process for preparing synthesis gas to obtain a synthesis gas;

d. cracking the ethane-comprising feed in a cracking zone under cracking conditions to obtain a cracking zone effluent comprising at least olefins and hydrogen;

e. providing at least part of the carbon dioxide-comprising feed and at least part the synthesis gas obtained in step c) to an oxygenate synthesis zone and synthesising oxygenates;

f. converting at least part of the oxygenates obtained in step (e) in an oxygenate-to-olefin zone to obtain an oxygenate-to-olefin comprising at least olefins and hydrogen;

g. combining at least part of the cracking zone effluent and at least part of the OTO zone effluent to obtain a combined effluent;

h. separating hydrogen from the combined effluent and providing at least part of the hydrogen to the oxygenate synthesis zone in step (e).

2. A process according to claim 1, comprising providing carbon dioxide, synthesis gas, and hydrogen to the oxygenate synthesis zone in a amount such that the molar ratio of hydrogen, carbon monoxide and carbon dioxide

provided to the oxygenate synthesis zone is of in the range of from 2.0 to 3.0, preferably 2.0 to 2.2.

3. A process according to claim 2, wherein carbon dioxide is present in a concentration in the range of from 0.1 to 25 mol%, preferably 3 to 15 mol%, more preferably of from 4 to 10 mol%, based on the total number of moles carbon dioxide, hydrogen, and preferably carbon monoxide.

4. A process according to any one of the preceding claims, wherein the olefins obtained in step (d) and/or (f) include ethylene and comprising:

- providing at least part of the ethylene to an ethylene oxidation zone together with a feed containing oxygen and performing a process for preparing ethylene oxide to obtain ethylene oxide and carbon dioxide; and
- providing at least part of the obtained carbon dioxide to the oxygenate synthesis zone.

5. A process according to any one of the preceding claims, wherein the olefins obtained in step (d) and/or (f) include ethylene and comprising:

- converting at least part of the ethylene with benzene to obtain styrene monomer and hydrogen; and
- providing at least part of the obtained hydrogen to the oxygenate synthesis zone.

6. A process according to any one of the preceding claims, wherein feed comprising at least methane, ethane and carbon dioxide is obtained from natural gas or associated gas.

7. A process according to any one of the preceding claims, wherein feed comprising at least methane, ethane and carbon dioxide comprises in the range of from 0.1 to 70 mol% of carbon dioxide, more preferably of from 0.5 to

35 mol%, even more preferably of from 1 to 30 mol%, based on the total content of the feedstock.

8. An integrated system for producing olefins, which system comprises:

a. a separation system, having at least an inlet for a feed comprising methane, ethane and carbon dioxide, and an outlet for a methane-comprising feed, an outlet for an ethane-comprising feed and an outlet for a carbon dioxide-comprising feed;

b. a partial oxidation system arranged to partially oxidise the methane-composing feed to a synthesis gas, having an inlet for a methane-comprising feed to receive the methane-comprising feed from the separation system, an inlet for oxygen, and an outlet for synthesis gas;

c. a steam cracking system having one or more inlets for an ethane-comprising feed to receive the methane-comprising feed from the separation system and an inlet for steam, and an outlet for a cracker effluent comprising olefins;

d. an oxygenate-to-olefins conversion system, having one or more inlets for receiving an oxygenate feedstock, and comprising a reaction zone for contacting the oxygenate feedstock with an oxygenate conversion catalyst under oxygenate conversion conditions, and an outlet for an oxygenate-to-olefins effluent comprising olefins, including at least ethylene;

e. a work-up system arranged to receive at least part of the cracker effluent and at least part of the oxygenate-to-olefins effluent to obtain a combined effluent, the work-up section comprising a separation system, an outlet for ethylene and an outlet for hydrogen;

f. an oxygenate synthesis system having one or more inlets for synthesis gas to receive the synthesis gas from partial oxidation system, an inlet for hydrogen and an inlet for a carbon dioxide-comprising feed to receive the carbon dioxide-comprising feed from the separation system, and an outlet for an oxygenate feedstock; and means for providing the oxygenate feedstock from the outlet for oxygenate feedstock of the oxygenate synthesis system to the oxygenate feedstock inlet of the oxygenate-to-olefins conversion system and means for providing hydrogen from the outlet for hydrogen of the work-up section to the inlet for hydrogen of the oxygenate synthesis system.

What is claimed is:

1. A process for producing olefins, comprising: a. providing a feed comprising at least methane, ethane and carbon dioxide; b. separating the feed into at least a methane-comprising feed, an ethane-comprising feed and a carbon dioxide-comprising feed; c. providing at least part of the methane-comprising feed to a process for preparing synthesis gas to obtain a synthesis gas; d. cracking the ethane-comprising feed in a cracking zone under cracking conditions to obtain a cracking zone effluent comprising at least olefins and hydrogen; e. providing at least part of the carbon dioxide-comprising feed and at least part the synthesis gas obtained in step c) to an oxygenate synthesis zone and synthesising oxygenates; f. converting at least part of the oxygenates obtained in step (e) in an oxygenate-to-olefin zone to obtain an oxygenate-to-olefin zone effluent comprising at least olefins and hydrogen; g. combining at least part of the cracking zone effluent and at least part of the OTO zone effluent to obtain a combined effluent; h. separating hydrogen from the combined effluent and providing at least part of the hydrogen to the oxygenate synthesis zone in step (e).

2. A process according to claim 1, comprising providing carbon dioxide, synthesis gas, and hydrogen to the oxygenate synthesis zone in a amount such that the molar ratio of hydrogen, carbon monoxide and carbon dioxide provided to the oxygenate synthesis zone is in the range of from 2.0 to 3.0.

3. A process according to claim 2, wherein carbon dioxide is present in a concentration in the range of from 0.1 to 25 mol %, based on the total number of moles of carbon dioxide, hydrogen, and carbon monoxide.

4. A process according to claim 1, wherein the olefins obtained in step (d) and/or (f) include ethylene, the process further comprising: providing at least part of the ethylene to an ethylene oxidation zone together with a feed containing oxygen and performing a process for preparing ethylene oxide to obtain ethylene oxide and carbon dioxide; and providing at least part of the obtained carbon dioxide to the oxygenate synthesis zone.

5. A process according to claim 1, wherein the olefins obtained in step (d) and/or (f) include ethylene, the process further comprising: converting at least part of the ethylene with benzene to obtain styrene monomer and hydrogen; and providing at least part of the obtained hydrogen to the oxygenate synthesis zone.

6. A process according to claim 1, wherein feed comprising at least methane, ethane and carbon dioxide is obtained from natural gas or associated gas.

7. A process according to claim 1, wherein feed comprising at least methane, ethane and carbon dioxide comprises in the range of from 0.1 to 70 mol % of carbon dioxide, based on the total content of the feedstock.

8. An integrated system for producing olefins, which system comprises: a. a separation system, having at least an inlet for a feed comprising methane, ethane and carbon dioxide, and an outlet for a methane-comprising feed, an outlet for an ethane-comprising feed and an outlet for a carbon dioxide-comprising feed; b. a partial oxidation system arranged to partially oxidise the methane-comprising

feed to a synthesis gas, having an inlet for a methane-comprising feed to receive the methane-comprising feed from the separation system, an inlet for oxygen, and an outlet for synthesis gas; c. a steam cracking system having one or more inlets for an ethane-comprising feed to receive the methane-comprising feed from the separation system and an inlet for steam, and an outlet for a cracker effluent comprising olefins; d. an oxygenate-to-olefins conversion system, having one or more inlets for receiving an oxygenate feedstock, and comprising a reaction zone for contacting the oxygenate feedstock with an oxygenate conversion catalyst under oxygenate conversion conditions, and an outlet for an oxygenate-to-olefins effluent comprising olefins, including at least ethylene; e. a work-up system arranged to receive at least part of the cracker effluent and at least part of the oxygenate-to-olefins effluent to obtain a combined effluent, the work-up section comprising a separation system, an outlet for ethylene and an outlet for hydrogen; and f. an oxygenate synthesis system having one or more inlets for synthesis gas to receive the synthesis gas from the partial oxidation system, an inlet for hydrogen and an inlet for a carbon dioxide-comprising feed to receive the carbon dioxide-comprising feed from the separation system, and an outlet for an oxygenate feedstock; and means for providing the oxygenate feedstock from the outlet for oxygenate feedstock of the oxygenate synthesis system to the oxygenate feedstock inlet of the oxygenate-to-olefins conversion system and means for providing hydrogen from the outlet for hydrogen of the work-up section to the inlet for hydrogen of the oxygenate synthesis system.