

C L A I M S

1. A process for converting feed streams selected from
(1) a gas stream comprising carbon dioxide and a hydrogen
rich gas stream;
- 5 (2) a methane rich gas stream; and
(3) a combination of feed streams (1) and (2)
into a product stream comprising carbon monoxide, water and
hydrogen, the process comprising
introducing feed streams selected from (1), (2) or (3) and
10 oxygen into a reaction vessel, wherein the process comprises
in switching mode performing method I or method II in the
reaction vessel wherein no catalyst is present, the reaction
vessel being provided with a burner located at the top of the
reaction vessel, the burner comprising coaxial channels for
15 the separate introduction of the different gas streams:
(method I) performing a reverse water gas shift reaction at
elevated temperature, wherein
(a) at least feed stream (1) and an oxygen rich gas stream
are introduced into the reaction vessel via the burner in
20 separate feed streams, wherein the hydrogen rich gas stream
is introduced into the reaction vessel at a temperature
between 15 and 500°C,
(b) the hydrogen rich gas stream and oxygen rich gas stream
being introduced in close vicinity of each other, wherein
25 the hydrogen and oxygen in the hydrogen rich gas stream and
oxygen rich gas stream undergo a combustion reaction upon
entering the reaction vessel, thereby providing the heating
energy required for the reverse water-gas shift reaction; and
(c) the temperature in the reaction vessel is maintained in
30 the range of 1000 to 1500°C by varying the molar ratio of
hydrogen to oxygen, which are introduced into the reaction

vessel in the hydrogen rich gas stream and oxygen rich gas stream, respectively; and

(method **II**) performing a partial oxidation reaction at elevated temperature, wherein

5 (d) at least feed stream (2) and an oxygen rich gas stream are introduced into the reaction vessel via the burner in separate feed streams,

(e) feed stream (2) and the oxygen rich gas stream being introduced in close vicinity of each other, wherein feed
10 stream (2) and the oxygen rich gas stream undergo a partial oxidation reaction upon entering the reaction vessel; and
(f) the temperature in the reaction vessel is maintained in the range of 1100 to 1500°C by varying the flow rate of oxygen and/or feed stream (2);

15 wherein during the switching mode from method **I** to method **II** or vice versa, the feed streams are gradually changed to the relevant feed streams, so that feed stream (3) is present in an intermediate phase, the feed streams being introduced via the appropriate channels, while also changing the temperature of
20 the reactor to the desired temperature for the relevant method.

2. A process according to claim 1, wherein feed streams can be selected without change in equipment or stopping the process by either gradually increasing the flow of feed stream (1) while gradually decreasing the flow of feed stream
25 (2), and vice versa, by opening and closing valves of the respective feed streams feeding to the burner, while continuing the flow of oxygen and adapting that as required.

3. A process according to claim 1 or 2, wherein in the process the percentage of the feed streams (1) and (2) in
30 feed stream (3) may be varied over time as required along with the variation of the oxygen rich gas stream.

4. A process according to any one of claims 1 to 3, wherein the reaction vessel is preheated to a temperature ranging up to 1100°C.
5. A process according to any one of claims 1 to 4, wherein
5 one or more feed streams selected from feed streams (1) and (2) along with the oxygen rich gas stream are preheated before being introduced into the reaction vessel.
6. A process according to any one of claims 1 to 5, wherein at least part of the hydrogen rich gas stream and/or at least
10 part of the oxygen rich gas stream in the feed is obtained from a water splitter.
7. A process according to any one of the claims 1 to 6, wherein in method I part of the gas stream containing carbon dioxide is introduced via a channel in between the hydrogen
15 rich gas stream and the oxygen rich gas stream and the remaining part of the gas stream containing carbon dioxide is introduced in an outer channel of the burner, being outside of the channels for the hydrogen rich gas stream and oxygen rich gas stream.
- 20 8. A process according to any one of the claims 1 to 7, wherein in method I the oxygen rich gas stream is introduced via the inner channel(s) of the burner.
9. A process according to any one of the claims 1 to 8, wherein in method II the oxygen rich gas stream is introduced
25 via the inner channel(s) of the burner.
10. A process according to any one of the claims 1 to 9, wherein in both methods I and II the oxygen rich gas stream is introduced via the inner channel(s) of the burner.