CLAIMS

WHAT IS CLAIMED IS:

1. A coke regulation and control reactor, wherein the coke regulation and control reactor comprises a coke regulation and control reactor shell, a reaction zone I, and a coke controlled catalyst settling zone;

the coke regulation and control reactor shell comprises an upper coke regulation and control reactor shell and a lower coke regulation and control reactor shell; the upper coke regulation and control reactor shell encloses the coke controlled catalyst settling zone;

the lower coke regulation and control reactor shell encloses the reaction zone I;

the reaction zone I communicates with the coke controlled catalyst settling zone;

a cross-sectional area at any position of the reaction zone I is less than a cross-sectional area at any position of the coke controlled catalyst settling zone;

n baffles are arranged in a vertical direction in the reaction zone I, bottoms of the n baffles are connected to a bottom of the coke regulation and control reactor, tops of the n baffles are located in the coke controlled catalyst settling zone, and the n baffles divide the reaction zone I into m reaction zone I subzones, wherein m and n are both integers; and

a catalyst circulation hole is formed in each of the baffles, such that a catalyst flows in the reaction zone I in a preset manner.

2. The coke regulation and control reactor according to claim 1, wherein $1 \leq n \leq 9$and $2 \leq m \leq 10$;

wherein preferably cross sections of the reaction zone I and the reaction zone I subzones are all rectangular; the catalyst circulation hole is formed in each of the n baffles; and the catalyst circulation holes on two adjacent baffles are staggered up and down, such that the catalyst flows in the reaction zone I a polyline manner;

wherein preferably a cross section of the reaction zone I is circular; a cross section of each of the reaction zone I subzones is fan-shaped; and at least one catalyst circulation hole is formed in each of n-1 of the baffles, such that the catalyst flows in the reaction zone I in an annular manner;

wherein preferably a cross section of the

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reaction zone I is annular; a cross section of each of the reaction zone I subzones is fan-shaped; and at least one catalyst circulation hole is formed in each of n-1 of the baffles, such that the catalyst flows in the reaction zone I in an annular manner.

3. The coke regulation and control reactor according to claim 1, wherein a cross-sectional area of the coke controlled catalyst settling zone is 1.5 to 3 times a cross-sectional area of the reaction zone I;

preferably, the coke regulation and control reactor is a bubbling fluidized bed reactor.

4. The coke regulation and control reactor according to claim 1, wherein the coke regulation and control reactor further comprises a transition zone;

the transition zone is located between the reaction zone I and the coke controlled catalyst settling zone;

a cross-sectional area at any position of the transition zone is between the cross-sectional area at any position of the reaction zone I and the cross-sectional area at any position of the coke controlled catalyst settling zone; and

the transition zone, the reaction zone I, and the coke controlled catalyst settling zone communicate with each other coaxially.

5. The coke regulation and control reactor according to claim 1, wherein the reaction zone I comprises a catalyst inlet, a coke controlled catalyst outlet, and a coke control raw material inlet;

the m reaction zone I subzones comprise a 1^{st} reaction zone I subzone, and a 2^{nd} reaction zone I subzone to an m^{th} reaction zone I subzone; the catalyst inlet is formed in the 1^{st} reaction zone I subzone; the coke controlled catalyst outlet is formed in the m^{th} reaction zone I subzone;

the coke control raw material inlet is formed at a bottom of each of the reaction zone I subzones;

the coke controlled catalyst settling zone comprises a coke control gas outlet; and the coke control gas outlet is formed at a top of the coke controlled catalyst settling zone;

wherein preferably, a coke regulation and control reactor distributor is provided at the coke control raw material inlet.

6. A device for preparing light olefin from an oxygen-containing compound, wherein the device comprises a methanol conversion reactor and the coke regulation and control reactor according to claim 1.

7. The device according to claim 6, wherein the methanol conversion reactor comprises a methanol conversion reactor shell and a delivery pipe;

the methanol conversion reactor shell comprises a lower methanol conversion reactor shell and an upper methanol conversion reactor shell;

the lower methanol conversion reactor shell encloses a reaction zone II;

the delivery pipe is located above the reaction zone II; the delivery pipe has one end closed and the other end communicating with the reaction zone II;

the upper methanol conversion reactor shell is arranged on a periphery of the delivery pipe;

the upper methanol conversion reactor shell and a pipe wall of the delivery pipe enclose a

cavity;

the cavity is divided into a spent catalyst zone and a gas-solid separation zone from bottom to top, respectively; and

the spent catalyst zone is provided with a spent catalyst zone gas distributor;

preferably, the gas-solid separation zone is provided with a first gas-solid separation unit of the methanol conversion reactor;

an upper part of the delivery pipe is connected to an inlet of the first gas-solid separation unit of the methanol conversion reactor;

a spent catalyst outlet of the first gas-solid separation unit of the methanol conversion reactor is formed in the spent catalyst zone;

a gas outlet of the first gas-solid separation unit of the methanol conversion reactor communicates with a methanol conversion reactor gas collection chamber; and

the methanol conversion reactor gas collection chamber communicates with a product gas delivery pipe;

preferably, the gas-solid separation zone is further provided with a second gas-solid separation unit of the methanol conversion reactor;

a gas inlet of the second gas-solid separation unit of the methanol conversion reactor is formed in the gas-solid separation zone;

a spent catalyst outlet of the second gas-solid separation unit of the methanol conversion reactor is formed in the spent catalyst zone; and

a gas outlet of the second gas-solid separation unit of the methanol conversion reactor communicates with the methanol conversion reactor gas collection chamber.

8. The device according to claim 7, wherein the spent catalyst zone gas distributor is located below the first gas-solid separation unit of the methanol conversion reactor and the second gas-solid separation unit of the methanol conversion reactor.

9. The device according to claim 7, wherein a spent catalyst circulation pipe and a spent catalyst inclined pipe are further arranged outside the spent catalyst zone;

the spent catalyst circulation pipe is configured to connect the spent catalyst zone and the reaction zone II; and

the spent catalyst inclined pipe is configured to output a spent catalyst.

10. The device according to claim 7, wherein the reaction zone II communicates with the reaction zone I through a coke controlled catalyst delivery pipe.

11. The device according to claim 6, wherein the device further comprises a regenerator;

the regenerator is connected to a spent catalyst inclined pipe, such that a spent catalyst is able to be delivered to the regenerator;

the regenerator is connected to a regenerated catalyst delivery pipe, such that a regenerated catalyst is able to be delivered to the coke regulation and control reactor; and

an inner bottom of the regenerator is provided with a regenerator distributor;

preferably, a bottom of the regenerator is further provided with a regenerator stripper;

an upper section of the regenerator stripper is arranged inside the regenerator, and an inlet of the upper section of the regenerator stripper is formed above the regenerator distributor; and

a lower section of the regenerator stripper is arranged outside the regenerator, and an outlet of the lower section of the regenerator stripper is connected to the regenerated catalyst delivery pipe;

preferably, the regenerator is connected to the spent catalyst inclined pipe through a spent catalyst delivery pipe and a methanol conversion reactor stripper; and

the regenerator is connected to the regenerated catalyst delivery pipe through the regenerator stripper;

preferably, the regenerator is further provided with a regenerator gas-solid separation unit and a regenerator gas collection chamber;

a regenerated catalyst outlet of the regenerator gas-solid separation unit is formed above the regenerator distributor;

a gas outlet of the regenerator gas-solid separation unit is connected to the regenerator gas collection chamber; and

the regenerator gas collection chamber is connected to a flue gas delivery pipe located outside the regenerator.

12. A method for on-line modification of a DMTO catalyst using the coke regulation and control reactor according to claim 1, wherein the method at least comprises: feeding a catalyst and a coke control raw material into the reaction zone I to allow a reaction to generate a product with a coke controlled catalyst,

wherein the catalyst flows in a preset manner through the catalyst circulation holes on the baffles;

preferably, the coke control raw material comprises C1-C6 hydrocarbon compounds;

preferably, the hydrocarbon compounds are at least one selected from the group consisting of C1-C6 alkanes and C1-C6 olefins;

preferably, the coke control raw material further comprises at least one from the group consisting of hydrogen, alcohol compound, and water; and a proportion of a total mass of the alcohol compound and the water in a mass of the coke control raw material is greater than or equal to 10% and less than or equal to 50%;

preferably, the alcohol compound is at least one selected from the group consisting of methanol and ethanol;

preferably, the coke control raw material comprises 0 wt% to 20 wt% of hydrogen, 0 wt% to 50 wt% of methane, 0 wt% to 50 wt% of ethane, 0 wt% to 20 wt% of ethylene, 0 wt% to 50 wt% of propane, 0 wt% to 20 wt% of propylene, 0 wt% to 90 wt% of butane, 0 wt% to 90 wt% of butene, 0 wt% to 90 wt% of pentane, 0 wt% to 90 wt% of pentene, 0 wt% to 90 wt% of hexane, 0 wt% to 90 wt% of hexene, 0 wt% to 50 wt% of methanol, 0 wt% to 50 wt% of ethanol, and 0 wt% to 50 wt% of water; and a content of the hydrocarbon compounds is greater than 0%.

13. The method according to claim 12, wherein the catalyst comprises an SAPO-34 molecular sieve; a coke content in the catalyst is less than or equal to 3 wt%;

a coke content in the coke controlled catalyst is 4 wt% to 9 wt%;

a quartile deviation of a coke content distribution in the coke controlled catalyst is less than 1 wt%;

preferably, coke species in the coke controlled catalyst comprise polymethylbenzene and polymethylnaphthalene;

a total mass of the polymethylbenzene and the polymethylnaphthalene accounts for greater than or equal to 70 wt% of a total mass of coke;

a mass of coke species with a molecular weight greater than 184 accounts for less than or equal to 25 wt% of the total mass of coke; and

the total mass of coke refers to a total mass of coke species.

14. The method according to claim 12, wherein process operating conditions of the reaction zone I of the coke regulation and control reactor are as follows: apparent gas linear velocity: 0.1 m/s to 0.5 m/s; reaction temperature: 300°C to 700°C; reaction pressure: 100 kPa to 500 kPa; and bed density: 400 kg/m3 to 800 kg/m3;

preferably, the method comprises: feeding a coke control raw material and a catalyst into the reaction zone I to allow a reaction to generate a coke controlled catalyst and a coke control product gas; allowing the coke controlled catalyst to pass through the m reaction zone I subzones in sequence through the catalyst circulation holes on the baffles and then flow out through the coke controlled catalyst outlet; and allowing the coke control product gas to flow out through the coke control gas outlet.

15. A method for preparing light olefin from an oxygen-containing compound using the device according to claim 6,wherein the method for preparing light olefin from the oxygen-containing compound further comprises:

feeding a coke control product gas into a gas-solid separation zone of the methanol conversion reactor; and

feeding a coke controlled catalyst into a reaction zone II of the methanol conversion reactor;

preferably, in the reaction zone II, a raw material with the oxygen-containing compound contacts and reacts with the coke controlled catalyst to generate a stream A with light olefins and a spent catalyst;

preferably, the stream A is separated into a gas-phase stream B and a solid-phase stream C after being subjected to gas-solid separation in the gas-solid separation zone of the methanol conversion reactor;

the gas-phase stream B enters a methanol conversion reactor gas collection chamber;

the solid-phase stream C enters a spent catalyst zone; and

the gas-phase stream B comprises the light olefins, and the solid-phase stream C comprises the spent catalyst;

preferably, a spent catalyst zone fluidizing gas is fed into the spent catalyst zone;

the spent catalyst zone fluidizing gas and a coke control product gas are mixed and carry a part of the spent catalyst to produce a stream D;

the stream D is separated into a gas-phase stream E and a solid-phase stream F after being subjected to gas-solid separation;

the gas-phase stream E enters the methanol conversion reactor gas collection chamber;

the solid-phase stream F enters the spent catalyst zone;

the gas-phase stream E is a mixed gas of the spent catalyst zone fluidizing gas and the coke control product gas; and

the solid-phase stream F is the spent catalyst;

preferably, the gas-phase stream B and the gas-phase stream E are mixed in the methanol conversion reactor gas collection chamber to produce a product

gas, and the product gas enters a downstream working section through a product gas delivery pipe;

preferably, a part of the spent catalyst in the spent catalyst zone is returned to a bottom of the reaction zone II through a spent catalyst circulation pipe; and

the remaining part of the spent catalyst is discharged through a spent catalyst inclined pipe;

preferably, the spent catalyst discharged through the spent catalyst inclined pipe is fed into a regenerator; and

a regeneration gas is fed into the regenerator to contact and react with the spent catalyst to obtain a stream G with a flue gas and a regenerated catalyst;

preferably, the stream G is subjected to gas-solid separation;

a separated flue gas enters a regenerator gas collection chamber, and then enters a downstream flue gas treatment system through a flue gas delivery pipe; and

a separated regenerated catalyst is stripped and cooled, and then enters a coke regulation and control reactor.

16. The method according to claim 15, wherein the oxygen-containing compound comprises methanol and/or dimethyl ether (DME);

preferably, a coke content in the spent catalyst is 9 wt% to 13 wt%.

17. The method according to claim 15, wherein the spent catalyst zone fluidizing gas comprises nitrogen and/or water vapor;

preferably, the regeneration gas comprises 0 wt% to 100 wt% of air, 0 wt% to 50 wt% of oxygen, 0 wt% to 50 wt% of nitrogen, and 0 wt% to 50 wt% of water vapor.

18. The method according to claim 15, wherein process operating conditions of the

reaction zone II of the methanol conversion reactor are as follows: apparent gas linear velocity: 0.5 m/s to 7.0 m/s; reaction temperature: 350°C to 550°C; reaction pressure: 100 kPa to 500 kPa; and bed density: 100 kg/m^3 to 500 kg/m^3;

preferably, process operating conditions of the spent catalyst zone of the methanol conversion reactor are as follows: apparent gas linear velocity: 0.1 m/s to 1.0 m/s; reaction temperature: 350°C to 550°C; reaction pressure: 100 kPa to 500 kPa; and bed density: 200 kg/m^3 to 800 kg/m^3.

19. The method according to claim 15, wherein process operating conditions of the regenerator are as follows: apparent gas linear velocity: 0.5 m/s to 2.0 m/s; regeneration temperature: 600°C to 750°C; regeneration pressure: 100 kPa to 500 kPa; and bed density: 150 kg/m^3 to 700 kg/m^3.