Claims

1. A turbulent fluidized-bed reactor for preparing propylene and C4 hydrocarbons from oxygen-containing compounds, comprising a reactor shell, n reactor feed distributors, a reactor gas-solid separator 1, a reactor gas-solid separator 2, a reactor heat collector, a product gas outlet and a reactor stripper, wherein the lower part of the turbulent fluidized-bed reactor is a reaction area, the upper part of the turbulent fluidized-bed reactor is a settling area, the n reactor feed distributors are disposed in the reaction area from bottom to top, the reactor heat collector is disposed in the reaction area, the reactor gas-solid separator 1 and the reactor gas-solid separator 2 are placed in the settling area or outside the reactor shell, the reactor gas-solid separator 1 is equipped with a regenerative catalyst inlet, the catalyst outlet of the reactor gas-solid separator 1 is located at the bottom of the reaction area, the gas outlet of the reactor gas-solid separator 1 is located in the settling area, the inlet of the reactor gas-solid separator 2 is located in the settling area, the catalyst outlet of the reactor gas-solid separator 2 is placed in the reaction area, the gas outlet of the reactor gas-solid separator 2 is connected to the product gas outlet, the reactor stripper passes through the reactor shell from outside to inside at the bottom of the turbulent fluidized-bed reactor and is opened in the reaction area of the turbulent fluidized-bed reactor, a reactor stripping gas inlet is arranged at the bottom of the reactor stripper, and a spent catalyst outlet is arranged at the bottom of the reactor stripper.

2. The turbulent fluidized-bed reactor according to claim 1, wherein $0<n<10$.

3. The turbulent fluidized-bed reactor according to claim 1 or 2, wherein a horizontal height of opening of the reactor stripper in the reactor shell is higher than 1/10 a height of the reaction area.

4. The turbulent fluidized-bed reactor according to claim 1 or 2, wherein the reactor gas-solid separator 1 and the reactor gas-solid separator 2 are cyclone separators.

5. A device for preparing propylene and C4 hydrocarbons from oxygen-containing compounds, comprising the turbulent fluidized-bed reactor according to any one of claims 1 to 3 and a fluidized-bed regenerator for regenerating a catalyst.

6. The device according to claim 5, wherein the fluidized-bed regenerator is a turbulent fluidized-bed regenerator.

7. The device according to claim 5, wherein the fluidized-bed regenerator comprises a regenerator shell, a regenerator feed distributor, a regenerator gas-solid separator, a regenerator heat collector, a flue gas outlet and a regenerator stripper, in which the lower part of the fluidized-bed regenerator is a regeneration area, the upper part of the fluidized-bed regenerator is a settling area, the regenerator feed distributor is placed at the bottom of the regeneration area, the regenerator heat collector is placed in the regeneration area, the regenerator gas-solid separator is placed in the settling area or outside the regenerator shell, the inlet of the regenerator gas-solid separator is disposed in the settling area, the catalyst outlet of the regenerator gas-solid separator is disposed in the regeneration area, the gas outlet of the regenerator gas-solid separator is connected to the flue gas outlet, and the regenerator stripper is opened at the bottom of the regenerator shell;

the spent catalyst outlet of the reactor stripper is connected to the inlet of a spent inclined pipe, a spent sliding valve is arranged in the spent inclined pipe, the outlet of the spent inclined pipe is connected to the inlet of a spent riser, the bottom of the spent riser is provided with a spent lift gas inlet, and the outlet of the spent riser is connected to the settling area of the fluidized-bed regenerator;

the bottom of the regenerator stripper is provided with a regenerator stripping gas inlet, the bottom of the regenerator stripper is connected to the inlet of a regeneration inclined pipe, a regeneration sliding valve is arranged in the regeneration inclined pipe, the outlet of the regeneration inclined pipe is connected to the inlet of a regeneration riser, the bottom of the regeneration riser is provided with a regeneration lift gas inlet, and the outlet of the regeneration riser is connected to the regenerative catalyst inlet of the reactor gas-solid separator 1.

8. A method for preparing propylene and C4 hydrocarbons from oxygen-containing compounds, including:

feeding a raw material containing an oxygen-containing compound from n reactor feed distributors to a

reaction area of a turbulent fluidized-bed reactor, and contacting the raw material with a catalyst, to generate a stream containing propylene and C4 hydrocarbons product and a spent catalyst containing carbon;

sending the stream discharged from the turbulent fluidized-bed reactor containing propylene and C4 hydrocarbons product into a product separation system, obtaining propylene, C4 hydrocarbons, light fractions, propane and hydrocarbons of C5 and above after separation, wherein the light fractions contain more than 90 wt% of ethylene and a small amount of methane, ethane, hydrogen, CO and CO_2, returning 70 wt.% or more of the light fractions to the reaction area of the turbulent fluidized-bed reactor from the reactor feed distributor at the bottom-most of the turbulent fluidized-bed reactor, and reacting ethylene and the oxygen-containing compounds to perform an alkylation reaction in presence of the catalyst, to produce a product containing propylene;

regenerating the spent catalyst by a fluidized-bed regenerator, and after being gas-solid separated by a reactor gas-solid separator 1, the regenerative catalyst is fed to the bottom of the reaction area of the turbulent fluidized-bed reactor.

9. The method according to claim 8, wherein the method is carried out by using the device according to any one of claims 5 to 7.

10. The method according to claim 9, wherein

the spent catalyst passes through the reactor stripper, the spent inclined pipe, the spent sliding valve and the spent riser into the settling area of the fluidized-bed regenerator;

a regeneration medium enters the regeneration area of the fluidized-bed regenerator and reacts with the spent catalyst to perform calcination to produce a flue gas containing CO and CO_2 and the regenerative catalyst, and the flue gas is discharged after dust removal by the regenerator gas-solid separator;

the regenerative catalyst passes through the regenerator stripper, the regeneration inclined pipe, the regeneration sliding valve and the regeneration riser into the inlet of the reactor gas-solid separator 1, and after gas-solid separation, the regenerative catalyst enters the bottom of the reaction area of the turbulent fluidized-bed reactor;

a reactor stripping gas enters the reactor stripper via the reactor stripping gas inlet and contacts upstream with the spent catalyst, and then enters the turbulent fluidized-bed reactor; a spent lift gas enters the spent riser via the spent lift gas inlet and contacts downstream with the spent catalyst, and then enters the settling area of the fluidized-bed regenerator;

a regenerator stripping gas enters the regenerator stripper via the regenerator stripping gas inlet and contacts upstream with the regenerative catalyst, and then enters the fluidized-bed regenerator; a regeneration lift gas enters the regeneration riser via the regeneration lift gas inlet and contacts downstream with the regenerative catalyst, and then enters the inlet of the reactor gas-solid separator 1.

11. The method according to claim 8, wherein a circulating amount of the light fractions is 5-40 wt.% of the feeding amount of the oxygen-containing compound.

12. The method according to claim 8, wherein the carbon content of the spent catalyst is 5-12 wt.%, and the carbon content of the regenerative catalyst is less than 2 wt.%.

13. The method according to claim 10, wherein the oxygen-containing compound is methanol and/or dimethyl ether; and/or the regeneration medium is any one of air, oxygen-poor air or water vapor or a mixture thereof; and/or the reactor stripping gas, the regenerator stripping gas, the spent lift gas and the regeneration lift gas are water vapor or nitrogen.

14. The method according to claim 8, wherein the reaction conditions in the reaction area of the turbulent fluidized-bed reactor are: the apparent linear velocity of gas is in a range from 0.1 m/s to 2 m/s, the reaction temperature is in a range from 300°C to 550°C, the reaction pressure is in a range from 100 kPa to 500 kPa, and the bed density is in a range from 200 kg/m^3 to 1200 kg/m^3.

15. The method according to claim 8, wherein the reaction conditions in the regeneration area of the fluidized-bed regenerator are: the apparent linear velocity of gas is in a range from 0.1 m/s to 2 m/s, the

regeneration temperature is in a range from 500℃ to 750℃, the regeneration pressure is in a range from 100 kPa to 500 kPa, and the bed density is in a range from 200 kg/m^3 to 1200 kg/m^3.