# Claims

1. A method for preparing an anti-coking apparatus comprising: subjecting a low oxygen partial pressure gas and the apparatus to a contact reaction to produce an anti-coking apparatus having an oxide film on the inner surface;

the dew point of the low oxygen partial pressure gas is from -40℃ to 40℃.

2. The method of claim 1, wherein the materials of the apparatus comprise iron element and/or nickel element.

Preferably, the oxide film comprises chromium manganese oxide and metallic elements, the metallic elements are iron element and/or nickel element.

3. The method of claim 2, wherein the dew point of the low oxygen partial pressure gas and the content of metallic elements in the oxide film of the anti-coking apparatus satisfy the following relationship:

$(W1-W2)/W1= aT^2+ bT + c$ Formula I;

in Formula I, $-0.0039\leq a\leq -0.0001$, $0.001\leq b\leq 0.0294$, $0.7269\leq c\leq 0.8577$, $R^2\geq 0.879$;

wherein W1 denotes the content of metallic elements in the apparatus before the contact reaction, wt%; W2 denotes the content of the metallic elements in the oxide film of the apparatus after the contact reaction, wt%; T is the dew point of the low oxygen partial pressure gas, ℃.

4. The method of any one of claims 1-3, wherein the apparatus is at least one selected from the group consisting of an alloy furnace tube, a TLE and a light hydrocarbon aromatization reactor;

and/or, when the apparatus is an alloy furnace tube, the total content of metallic elements in the alloy furnace tube before the contact reaction is 25-90wt%;

and/or, when the apparatus is a TLE, the total content of metallic elements in the tube pass furnace tubes of TLE before the contact reaction is 76.4-98wt%;

and/or, the alloy material of the aromatization reactor is at least one selected from the group consisting of stainless steel 304, 316 and 321, more preferably, the alloy material of the aromatization reactor is stainless steel 304, and the content of metallic elements in the aromatization reactor before the contact reaction is 68-81wt%.

5. The method of claims 3 or 4, wherein $(W1-W2)/W1 \geq 0.281$.

6. The method of claim 3 or 4, wherein $(W1-W2)/W1 \geq 0.583$.

7. The method of any one of claims 3-6, wherein the dew point of the low oxygen partial pressure gas is within a range of -30 ℃ to 30 ℃;

in Formula I, $-0.0005 \leq a \leq -0.0003$, $0.001 \leq b \leq 0.0092$, $0.7355 \leq c \leq 0.8308$, $R^2 \geq 0.9539$.

8. The method of any one of claims 3-6, wherein the dew point of the low oxygen partial pressure gas is within a range of -20 ℃ to 20 ℃;

in Formula I, $-0.0006 \leq a \leq -0.0003$, $0.001 \leq b \leq 0.0092$, $0.7269 \leq c \leq 0.8308$, $R^2 \geq 0.879$.

9. The method of any of claims 3-6, wherein the dew point of the low oxygen partial pressure gas is within a range of -15 ℃ to 15 ℃;

in Formula I, $-0.0006 \leq a \leq -0.0005$, $0.0021 \leq b \leq 0.0049$, $0.7419 \leq c \leq 0.8109$, $R^2 \geq 0.879$.

10. The method of any one of claims 3-6, wherein the dew point of the low oxygen partial pressure gas is within a range of -15 ℃ to 10 ℃;

in Formula I, $-0.0005 \leq a \leq -0.0003$, $0.0021 \leq b \leq 0.0053$, $0.7419 \leq c \leq 0.8138$, $R^2 \geq 0.8943$.

11. The method of any one of claims 3-6, wherein the dew point of the low oxygen partial pressure gas is within a range of 0 ℃ to 10 ℃;

in Formula I, $a=-0.0022$, $b=0.0238$, $c=0.7787$, $R^2=0.9887$.

12. The method of any one of claims 1-11, wherein the low oxygen partial pressure gas is a gas mixture consisting of $CO_2$ and/or $H_2O$ and at least one selected from the group consisting of CO, $CH_4$, $C_2H_6$, $C_3H_8$, $NH_3$, $H_2$, $N_2$, Ar, He, air and pyrolysis gas;

and/or, the low oxygen partial pressure gas is at least one selected from the group consisting of a gas mixture of $CH_4$ and $H_2O$, a gas mixture of $CO_2$ and CO, a gas mixture of $H_2O$ and CO, and a gas mixture of $H_2O$ and $H_2$;

and/or, the method further comprises a step of measuring dew point of the low oxygen partial pressure gas.

13. The method of any one of claims 1-12, wherein the conditions of the contact reaction comprise: reaction temperature of 400-1,100 ℃; reaction time of 5-100h.

14. The method of any one of claims 1-12, wherein the conditions of the contact reaction comprise: reaction temperature of 600-1,100 ℃; reaction time of 5-72h.

15. The method of any one of claims 1-14, wherein the apparatus is an alloy furnace tube;

and/or, the alloy furnace tube comprises an enhanced heat transfer member fixed in the furnace tube.

16. The method of claim 15, wherein the enhanced heat transfer member is at least one selected from the group consisting of a twisted slice, an inner rib and an inner fin.

17. The method of claim 15 or 16, wherein the tubes with the enhanced heat transfer member have a length of 20-80cm, the number of said tubes is 1-200, and the tubes are distributed over different tube passes of the entire furnace tube.

18. An anti-coking apparatus manufactured with the method of any one of claims 1-17.

19. A use of the anti-coking apparatus of claim 18 in at least one of a cracking furnace, a TLE and an aromatization reactor.