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°C to 40°C;

wherein the apparatus is an alloy furnace tube；

wherein the alloy furnace tube comprises an enhanced heat transfer member fixed in the furnace tube;

wherein the metallic elements include 20-50wt% of nickel element and 5-40wt% of iron element in the alloy furnace tube, and the alloy furnace tube further comprises 12-50wt% of chromium element, 0.2-3wt% of manganese element, 1-3wt% of silicon element, 0.1-0.75wt% of carbon element, 0-5wt% of microelements and trace elements, in addition to the iron and nickel elements;

wherein 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.

2. The method of claim 1, wherein 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, °C.

4. The method of any one of claims 1-3, wherein the total content of metallic elements in the alloy furnace tube before the contact reaction is 25-90wt%.

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°C to 30°C;

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°C to 20°C;

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°C to 15°C;

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°C to 10°C;

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°C to 10°C;

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 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°C; 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°C; reaction time of 5-72h.

15. The method of claim 1, 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.

16. The method of claim 1, 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.