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**Test method of mercury removal rate for activated
carbon mercury removal catalyst**

活性炭脱汞催化剂脱汞率试验方法

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Test method of mercury removal rate for activated carbon mercury removal catalyst

1 Scope

This Standard specifies the test method of mercury removal rate for activated carbon mercury removal catalyst.

This Standard is applicable to activated carbon mercury removal catalyst that takes activated carbon as carrier; elemental sulfur, sulfide and metal oxide as active components, that is mainly used for removing mercury from natural gas, synthesis gas, refinery gas and industrial tail gas.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 6003.1, *Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth*

GB/T 6679, *General rules for sampling solid chemical products*

GB/T 16781.1, *Natural gas - Determination of mercury - Part 1: Sampling of mercury by chemisorption on iodine*

3 Principle

Trace mercury in feed gas under the action of catalyst, due to physical adsorption and chemical reaction, is removed. Through the determination of the mass concentration of mercury at the inlet and outlet of the reactor, calculate the mercury capacity of the catalyst, so as to characterize the mercury removal rate of the catalyst.

4 Test devices

4.1 Devices

to make the test material filled tight, uniform and flat. Then put on a glass cloth. Use quartz sand to fill to a position that is about 5mm from the inlet cross section of the reaction tube. Connect the reaction tube into the system.

6.3 System leakage test

Close all outlet and vent valves of the system. Make access to nitrogen. Boost the system to 0.1MPa. Close the system inlet valve. Use soap water to check the connection of each joint to test leakage. After the leakage test meets the requirements, open the system outlet valve to vent to reduce the system pressure to atmospheric pressure.

6.4 Absorption of mercury

Raise the temperature of the water bath to 35°C. Maintain the temperature constant. Make the system access to nitrogen. Control and adjust the system pressure as constant pressure, reactor temperature as 25°C and volumetric space velocity as 10000h^{-1} (see Annex B for gas-related flow correction). Meanwhile, record the initial reading of the wet gas flowmeter. After several hours (depending on the removal rate of mercury removal catalyst), start determining the mass concentration of mercury in the inlet and outlet of the reactor, once every 2h. When the mercury concentration in the exhaust gas is found to increase, determine once every 30min. When the mass concentration of mercury exceeds $100\mu\text{g}/\text{m}^3$, it shall immediately and continuously determine twice. If the determination result still exceeds $100\mu\text{g}/\text{m}^3$, it shall immediately turn off the mercury generator. At the same time, record the end reading of the wet gas flowmeter.

6.5 Determination of mercury mass concentration

6.5.1 Mass concentration of inlet mercury

Take an absorption bottle that is filled with 30mL of potassium permanganate-sulfuric acid solution (one volume of 40g/L potassium permanganate, one volume of 1+1 sulfuric acid solution and two volumes of water) to absorb 100mL of inlet gas. Measure 2.00mL of absorption fluid and move to a 100mL volumetric flask. Set constant volume and shake well. Then, according to the provisions of GB/T 16781.1, use atomic absorption spectroscopy to determine the mercury mass concentration.

6.5.2 Mass concentration of outlet mercury

Take an absorption bottle that is filled with 30mL of potassium permanganate-sulfuric acid solution (one volume of 40g/L potassium permanganate, one volume of 1+1 sulfuric acid solution and two volumes of water) to absorb 300mL of outlet gas. Measure 10.00mL of absorption fluid and move to a 100mL volumetric flask. Set constant volume and shake well. Then, according to the

Annex A

(normative)

Determination of compact density of catalyst specimen

A.1 Specimen accumulation

Divide an appropriate amount of specimen (see 5.2) into several portions. Add 25mL into a measuring cylinder in sequence. In each addition, it needs to shake the cylinder up and down several times until the position of the specimen in the measuring cylinder does not change to compaction. Repeat the operation till the compacted sample volume is 10mL.

A.2 Weighing of specimen

Weigh the mass of 10mL of compacted specimen (see A.1), to the nearest of 0.01g.

A.3 Calculation of compact density

The compact density ρ , in grams per milliliter (g/mL), is calculated according to formula (A.1):

$$\rho = \frac{m_2 - m_1}{V} \dots\dots\dots (A.1)$$

Where,

m_2 - Values of mass of 25mL measuring cylinder and mass of 10mL of specimen, in grams (g);

m_1 - Value of mass of 25mL measuring cylinder, in grams (g);

V - Value of specimen's volume, in milliliters (mL).

Calculation results are retained to two digits after the decimal point. Take the arithmetic mean of the parallel measurement results as the measurement results. The relative error of parallel determination results shall not be greater than 2.0%.

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