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**Particles - Gas-solid reaction measurement - Micro fluidized
bed method**

颗粒 气固反应测定 微型流化床法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. This standard is proposed and managed by the National Technical Committee for Particle Characterization and Sorting and Screen Standardization (SAC/TC168). This standard was drafted by: Institute of Process Engineering, Chinese Academy of Sciences, Shenyang University of Chemical Technology, Shenzhen Defang Nanotechnology Co., Ltd., China Institute of Test Technology, Southwest Chemical Research and Design Institute Co., Ltd., Institute of Chemistry, China Institute of Test Technology, Huazhong University of Science and Technology, Harbin Institute of Technology, Shanxi Institute of Coal Chemistry, Chinese Academy of Sciences, Zhangjiagang Jiushun Energy Technology Co., Ltd., Shanghai Tilun Vacuum Technology Co., Ltd., Beijing University of Science and Technology, China Aviation Manufacturing Technology Research Institute, Shandong University, China University of Petroleum (Beijing), Chongqing University, Beijing Zhong Kejiechuang Energy Technology Co., Ltd. The main drafters of this standard. Xu Guangwen, Yue Junrong, Wang Fang, Shang Weili, Li Zhaojun, Zhou Lan, Yang Jiebin, Wang Shaonan, Han Zhennan, Zeng Xi, Founder, Yu Jian, Liu Xuejing, Yao Hong, Sun Shaozeng, Han Yizhuo, Zhu Qingkai, Shen Lu, Guo Zhancheng, Cui Xiangzhong, Dong Yuping, Sun Guogang, Zheng Zhong, Yin Xiang.

Gas-solid reaction is a kind of reaction widely used in process industry, and its process is affected by chemical reaction and transmission. Research Response The nature, reaction mechanism, and calculation of reaction kinetic parameters are the foundation of process industry science and technology, and also an important content of testing science and technology. Therefore, the micro-fluidized bed method is used in this standard to test gas-solid reactions involving particulate reactants or catalysts. The concentration curve of the gas component released or generated by the chemical reaction that occurs under the constant temperature reaction condition with time can be obtained. The time required to

complete the reaction, the conversion rate and reaction rate at any reaction time, and the reaction activation energy for the formation of gas components can also be studied accordingly Reaction characteristics, analysis of product laws, speculation of reaction mechanism. Determination of particulate gas-solid reaction by micro fluidized bed method

1 Scope

China's national method for measuring gas-solid reactions using a micro fluidized bed. It specifies the terms and definitions, the principle, the test device composition and the reagents and materials. Measuring the kinetics of a reaction between a gas and a solid - combustion, gasification, calcination, reduction, adsorption - is harder than it looks, because the measurement is easily dominated by transport rather than by chemistry. In a thermogravimetric analyser, the standard instrument for this work, the sample sits in a crucible and the gas has to diffuse into a static bed while the heat has to conduct into it; at anything above a modest temperature, what is being measured is diffusion. A micro fluidized bed suspends a very small sample in the gas flow, so every particle is surrounded by fresh gas and heats almost instantly, and the reaction rate measured is the chemical one. For coal and biomass conversion research, where China's interest is considerable, that distinction is the whole point.

This standard specifies the characteristics of gas-phase products in gas-solid reactions involving particulate reactants or catalysts using a micro-fluidized bed reactor. Test methods, including principles, test device composition, reagents or materials, test methods and test reports. This standard applies to gas-solid reactions involving or involving gaseous materials.

Note. This standard method provides raw data for the study of gas-solid reaction, analysis of reaction mechanism, calculation of reaction kinetic parameters, etc. using a micro-fluidized bed reactor Test method.

2 Terms and definitions

The following terms and definitions apply to this document.

2.1 Fluidized bed reactor Use gas or liquid to pass through the granular solid layer to put the solid particles in a suspended motion state, and perform the gas-solid phase reaction process or liquid Reactor for solid phase reaction process.

2.2 Microfluidizedbedreactor A fluidized bed reactor with an inner diameter not greater than 20 mm and loaded with an appropriate amount of fluidizing medium.

Note. Refer to Appendix A for gas flow characteristics in the micro-fluidized bed.

2.3 Pulse-injection feed of particles A small amount of fine particles are injected into the micro fluidized bed reactor under preset conditions with gas at a high speed

Note 1. The amount of injected particles is about 10 mg, and the particle size is between 5 μm and 500 μm .

Note 2. The sampling process takes about 10ms.

2.4 Isothermal reaction in microfluidized bed The gas-solid reaction induced by a pulsed micro sample in a constant temperature micro-fluidized bed.

Note. It takes about 0.1s for the temperature rise of the particles below 100 μm in the micro fluidized bed, which is far less than the reaction time required to complete most reactions.

3 Principle

3.1 Overview With a micro-fluidized bed as the reactor, inert (silica sand) or catalyst particles as the fluidized medium, the furnace is heated to the preset temperature. After the reactor reaches the preset conditions, it uses particle pulse sampling to supply micro-fine particle samples to the micro-fluidized bed, and the rapid transmission through the fluidized bed Heat and mass transfer, the sample is instantly heated to the set temperature, and the isothermal reaction of the micro-fluidized bed is induced; the target component of the gas phase product is monitored online The concentration of the product changes with the reaction time, in order to calculate the time required to complete the reaction, the conversion rate and reaction rate at any reaction time, The activation energy of the reaction generated by the gas component provides raw data. Figure 1 is a schematic diagram of the principle of the micro fluidized bed method.