

STUDY ON THE APPLICATION OF NANOCATALYSTS IN OIL REFINING AND PETROCHEMICAL INDUSTRY

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Abstract: Nanocatalysts have special structures and excellent differences, expanding its application scope. Use of nanomaterials in refining and petrochemicals materials, the effect is remarkable, the application of nanocatalysts in these industries is reviewed, the existing problems are analyzed and the broad prospects are prospected.

Keywords: Nanocatalyst; Refining; Petrochemical Industry; Application; Progress

1 INTRODUCTION

Nanotechnology is three great developments in the 21st century. One of the obvious reasons is that the size of the material structure it studies is in 0.1 nm ~ 100 nm [1-3]. Nanomaterials are a type of ultrafine materials with small size effects, surface effects, some special properties such as macroscopic quantum tunneling effect. Therefore, it has become a multi-field concern hot spot, nanotechnology. The progress can provide new development space for chemistry, materials, physics, biology and other disciplines [4-5].

Nanocatalysts have been classified as the fourth generation catalysts, nanocatalysis technology is a hot spot in current research, and many fields such as petrochemicals, physics chemistry, chemical synthesis, et al. have all made extensive and extensive efforts in nanocatalysts. go deep of research study [6]. Accept rice urge change agent Knot structure ruler inch is 1 nm ~ 100 nm, Compared with traditional catalysts than it Greater selectivity, catalytic Higher activity, showing great achievements in the field of catalysts development prospects in Very good gains have been achieved in the fields of chemical synthesis, petrochemical industry, environmental protection, biology and energy [7].

2 PROPERTIES OF NANOCATALYSTS

2.1 Chemical Reaction Properties

The particle size of nanocatalyst is nanoscale, its properties are very active, and it has strong chemical reaction properties. Nanometal catalysts in the air medium energy oxidize, and burn to emit light, such as nano N The grain (45 nm) is heated can be burned in the air TiO₂ grains [8].

2.2 Catalytic Properties

Nanocatalysts have surface active centers. The increase has the effect of urging chemical activity. Nanocatalysts can be added to the reactant without external carriers. Due to the rough surface, the reaction area of nanocatalysts is relatively large.

2.3 Photocatalytic Properties

Nanocatalysts also have photocatalytic properties, and their photocatalytic properties and reaction The response velocity increases with decreasing particle size.

Nanocatalysts also have many advantages performance, such as high Specific heat, High conductivity and high magnetic susceptibility, et al. With technology With the progress, I believe that nanocatalysts will have more excellent properties [9].

3 NANOCATALYSTS IN REFINING AND PETROCHEMICAL INDUSTRIES APPLICATION

3.1 Oil Displacement

With the development of oil and gas, people pay more and more attention to the heavy oil open. Therefore, how to effectively extract heavy oil is becoming more and more important. will accept The use of rice particles for enhanced oil recovery means that they are proportional to the size of the pore throat. Ratio, nanometer The particles are smaller in size and they can to easily penetrate porous rocks without seriously affecting the penetration rate.

been proposed — Nanocatalyst In-position oil recovery technology (ISUT), this method is to extract oil from middle Recycle of Vacuum residual oil is injected into the reservoir together with nanocatalyst and H₂. layer Upgrade response. In heavy and extra-heavy oil reservoirs, ISUT works by permanently increasing oil production quality, so that out of

crude oil No need to add diluent or other additional processing to meet the needs of transportation pipelines transportation requirements. SuarezR. G. S. et al [10] Using experimental analysis Got it Nanocatalyst in-situ enhancement technology improves recovery rate of carbonate heavy oil reservoirs The results show that the use of nanocatalysts improves cracked and The quality of the oil in the matrix, can to improve carbonate heavy oil reservoirs recovery factor. By mixing nanocatalysts and polysurface agents, the two same hour Take advantage of this to significantly increase crude oil recovery.

3.2 Refinery Waste Gas Treatment

During oil refining, a lot of toxic and harmful gases are produced, which are harmful to the environment and human body. The harm is great. With the development of economy, people are paying more and more attention to the environment while improving their quality of life. The proper treatment of oil refining waste gas has become a matter of concern of ask Question [11]. With the advancement of technology, there are more and more applications of nanocatalysts, and the treatment of oil refining waste gas has attracted more and more attention. Add nanocatalyst, Waste gas can be treated Great efficiency and quality increase significantly. First of all, nanocatalysts can treat waste gas during oil refining. Absorb this preprocessing, So that the gas can be distributed more evenly to the distributor, the distributor middle Nanocatalysts can to convert oil refining waste gases into harmless gases. Secondly, Nanocatalysts can To degrade harmful organic pollutants and convert them into substances with very little or even no pollution. Especially for those organic pollutants that are difficult to degrade, the advantages of nanocatalysts are even more obvious. Carrier selection Fe₃O₄, Will SiO₂ wrapped in TiO₂ and Fe₃O₄ The nanocomposite catalyst obtained between O₄ has high catalytic efficiency and can be recycled again [12].

3.3 Hydrothermal Cracking and Viscosity Reduction

In recent years, petrochemical energy The demand for products has skyrocketed, and the trend of inferior and heavy - quality products is serious. Currently, the world's oil 70% of reserves are solid heavy oil, so many countries have invested a lot of money in heavy oil exploration and application research. Heavy oil solids must first reduce their viscosity before they can be used in practical applications middle. Hydrothermal cracking of heavy oil to reduce viscosity Relatively mature technical means, this technology has good Prospects for large-scale industrial promotion. Its mechanism is mainly transition metal activity Center attack heavy oil colloid and asphaltene components with weak bond energy CS, CN, C -O and a small amount CC bond can break the long chain of heavy oil macromolecules and reduce the viscosity. The key to hydrothermal cracking viscosity reduction of heavy oil lies in the design and preparation of catalysts. Among them nanocatalyst The characteristics of large specific surface area, small volume and stable chemical properties make it widely used in the hydrothermal cracking viscosity reduction reaction of heavy oil [13].

nanometer Fe₃O₄ The catalyst also contains Fe²⁺ and Fe³⁺, is one kind of trans tip Crystal structure, comparison table Large area, proportion of surface atoms High, strong catalytic activity. Take advantage of two different same Methods to prepare 4 kinds of sodium rice Fe₃O₄ catalysts, with different particle sizes, for hydrothermal cracking in Liaohe Oilfield When applied in viscosity reduction, the effect is remarkable [14]. Olvera et al [1 5] mix and grind metal front Body shape, Ni, Co. and W et al., to obtain nanocarbide (10 nm ~ 125 nm), in 200 °C, equivalent of sea water Under conditions Viscosity reduction for heavy oil samples (1.13 Pa ·s). The results showed that nanocarbon chemical catalytic performance Good, within 240h, with grinding hour increase in time plus, the viscosity reduction rate can be obtained from 80% increased to 97%.

3.4 Catalytic Desulfurization

With the development of the economy, on the one hand, the demand for oil resources has increased sharply. Increase, on the other hand, is not mined The petroleum resources have high viscosity and complex composition. complex, conventional catalysts often do not meet the need. Under the condition of external magnetic field, nanoparticles with magnetic and catalytic properties are used as Magnetic nanocatalyst, which has high activity and can recycling, raw The production efficiency is high and continuous production is possible.

in transportation fuel sulfides are very harmful because they can converted into sulfur oxides (SO_x), very toxic. At the same time, use magnetic Sexual carrier and desulfurization catalyst can reduce production costs and the catalyst Used longer and recycled. Zheng et al [16] through two tables Magnetic nanocatalyst prepared from surfactant MOS₂/SiO₂/Fe₃O₄, The average particle size is approx. 50nm, core-shell structure, in Experiment under 300K conditions Its catalytic properties were found to be good.

4 CONCLUSION

With the research on nanomaterials The continuous progress of nanocatalysts Its application is becoming more and more widespread, especially in oil refining and petrochemical fields. fruit more prominent. With research With the continuous deepening of research, nanocatalysts are more Many functions will be gradually developed, promoting its use in the field of catalysis status And the effect is further improved.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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