

Effective decay of ozone harming substance SF₆ by means of weighty metal strong waste de-ri-ved impetus.

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Abstract

Sulfur hexafluoride (SF₆) is an obstinate ozone harming substance. Cata-lytic disintegration of SF₆ was only here and there detailed. In this work, we integrated novel multi-metal containing impetuses from hefty metal strong squanders, and applied them in green cata-lytic disintegration of SF₆ interestingly. Accordingly, the waste-determined impetuses, which predominantly contained Cr, Cu and Fe oxides, astoundingly eliminated SF₆ at a limit of 1.10 mmol/g at 600oC. This dynamic temperature was 100-200oC lower than that of phosphate impetus, yet much lower than 5000 K by electrical circular segment detailed somewhere else. XRD examination showed that the strong stage changed from metal oxides (for example Fe₂O₃) to fluorides (for example FeF₃) with the utilization of SiO₂. Simultaneously, on-line FTIR investigation recognized that the developed gases were SO₂ and SiF₄, with no poisonous SOF₄, SO₂F₂ and SF₄ being identified. These created gases were promptly caught by antacid solu-tion. As per the above outcomes, the response somewhere in the range of SF₆ and SiO₂ was catalyzed by CrCuFe oxides in strong waste inferred material, bringing about the green decrease of SF₆. Moreover, tempered steel slag (SSS), another sort of multi-metal contain-ing strong waste, likewise deteriorated SF₆ viably at 600oC. By correlation, CaFeMgMn oxides in SSS catalyzed the response somewhere in the range of SF₆ and SiO₂. In this way, our works displayed that hefty metal strong waste was a sort of likely asset for the union of high-esteem added impetus.

An economic and facile method was urgently required for the degradation of SF₆ to replace the high-energy excitation treatment. Both theoretical calculations and experimental observations were conducted to reveal the synergy of Cr/Fe/Si composites on a new technique of SF₆ degradation through reacting silicon dioxide. Density functional theory (DFT) calculations show that strong adsorption of SF₆ on Cr₂O₃, and then the fast F/O exchange between CrF₃ and Fe₂O₃ (energy barrier was 1.45 eV) as well as FeF₃ and SiO₂ (energy barrier was 1.69 eV) enhanced mediated efficiency from SF₆ to SiF₄. The fluorine (F) migration between solid interfaces in Cr₂O₃&Fe₂O₃@SBA15 was responsible for efficient SF₆ removal. The F migration route was composed of SF₆ to CrF₃, CrF₃ to FeF₃, and FeF₃ to SiF₄ with the lowest thermodynamic driving

SACA was 13.98 mmol/g within 7 h, significantly higher than that on Fe₂O₃@SBA15 (5.74 mmol/g) and Cr₂O₃@SBA15 (2.71 mmol/g). Moreover, X-ray diffractometry and X-ray photoelectron spectroscopy were performed to support DFT calculations, including ion intensities detected using mass spectroscopy and composition analysis of the mediator during the reaction. Therefore, our work put forward a novel approach for economic and efficient SF₆ decomposition through reacting with silicon dioxide under the mediation of Cr₂O₃&Fe₂O₃. This method was also potentially used in effective degradation of refractory non-metal halides.

The contribution of this chapter is to deepen and widen existing knowledge on municipal solid waste (MSW) management by analyzing different energy recovery routes for MSW. The main aspects related to the composition of waste are addressed, as well as the technological routes for thermochemical and biochemical energy usage. Within the thermochemical route, incineration is currently the most utilized technology for energy recovery of waste, with generation of electricity and heat and also a decrease in the volume of the produced waste. Gasification and pyrolysis are alternatives for the production of chemical products from wastes.

Diesel engines have high efficiency, durability, and reliability together with their low-operating cost. These important features make them the most preferred engines especially for heavy-duty vehicles. The interest in diesel engines has risen substantially day by day. In addition to the widespread use of these engines with many advantages, they play an important role in environmental pollution problems worldwide. Diesel engines are considered as one of the largest contributors to environmental pollution caused by exhaust emissions, and they are responsible for several health problems as well. Many policies have been imposed worldwide in recent years to reduce negative effects of diesel engine emissions on human health and environment. Many researches have been carried out on both diesel exhaust pollutant emissions and aftertreatment emission control technologies. In this paper, the emissions from diesel engines and their control systems are reviewed. The four main pollutant emissions from diesel engines (carbon monoxide-CO, hydrocarbons-HC, particulate matter-PM and nitrogen oxides-NOx) and control systems for these emissions (diesel oxidation catalyst,

diesel particulate filter and selective catalytic reduction) are discussed. Each type of emissions and control systems is comprehensively examined. At the same time, the legal restrictions on exhaust-gas emissions around the world and the effects of exhaust-gas emissions on human health and environment are explained in this study.

Sulfur hexafluoride (SF₆) is a refractory greenhouse gas. Catalytic decomposition of SF₆ was seldom reported. In this work, we synthesized novel multi-metal containing catalysts from

heavy-metal solid wastes, and applied them in green catalytic decomposition of SF₆ for the first time. As a result, the waste-derived catalysts, which mainly contained Cr, Cu and Fe oxides, remarkably removed SF₆ at a capacity of 1.10 mmol/g at 600°C. This active temperature was 100-200°C lower than that of phosphate catalyst, but much lower than 5000 K by electrical arc reported elsewhere. XRD analysis showed that the solid phase transformed from metal oxides (e.g. Fe₂O₃) to fluorides (e.g. FeF₃) with the consumption of SiO₂. At the same time, on-line FTIR analysis detected that the