Effective decomposition of greenhouse gas SF_6 via heavy-metal solid waste derived catalyst

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Sulfur hexafluoride (SF_6) is a refractory greenhouse gas. Catalytic decomposition of SF_6 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 SF_6 for the first time. As a result, the waste-derived catalysts, which mainly contained Cr, Cu and Fe oxides, remarkably removed SF_6 at a capacity of 1.10m mol/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. Fe_2O_3) to fluorides (e.g. FeF_3) with the consumption of SiO_2. At the same time, on-line FTIR analysis detected that the evolved gases were SO_2 and SiF_4, with no toxic SOF_4, SO_2F_2 and SF_4 being detected. These generated gases were readily captured by alkaline solution. According to the above results, the reaction between SF_6 and SiO_2 was catalysed by CrCuFe oxides in solid waste derived material, resulting in the green reduction of SF_6. Furthermore, Stainless Steel Slag (SSS), another kind of multi-metal containing solid waste, also decomposed SF_6 effectively at 600°C. By comparison, CaFeMgMn oxides in SSS catalysed the reaction between SF_6 and SiO_2. Therefore, our works exhibited that heavy-metal solid waste was a kind of potential resource for the synthesis of high-value added catalyst

Biography: Jia Zhang is currently an Associated Professor in SHU Center of Green Urban Mining & Industry Ecology, School of Environmental and Chemical Engineering, Shanghai University. He also works in Shanghai Institute of Materials Genome. Dr Zhang's research interest and expertise mainly focused on high-value-added utilization of hazardous solid waste. To this aim, he synthesized catalyst from heavy-metal containing waste, and applied it in various catalysis, including decomposition of greenhouse gas SF_6, selective catalytic reduction of nitric oxide, catalytic oxidization of hydrogen sulfide, photocatalytic decomposition of organic waste and Fischer-Tropsch synthesis. Besides, he is working on CH_4/H_2S conversion to H_2 from landfill gas by heavy-metal containing waste-derived catalyst at present. Dr Zhang has authored/co-authored >20 journal publications in the areas of high-value-added utilization of hazardous solid waste.

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