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论文

负载型MnOx/Al2O3催化剂低温下脱除烟气中单质汞特性

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摘要：

针对燃煤烟气中单质汞(Hg0)因不溶于水很难去除的问题，以浸渍法制备的负载型MnOx/Al2O3为催化剂，在固定床实验台架上，考察前驱体、负载量、煅烧温度、反应温度和烟气成分对Hg0的催化氧化影响；采用N2吸附/脱附、扫描电镜(SEM)和X射线衍射(XRD)对催化剂进行表征。结果表明，硝酸锰浸渍催化剂的脱汞效率优于醋酸锰浸渍催化剂，催化剂的主要活性成分为MnO2；MnOx的表面形貌和存在形态是硝酸锰浸渍催化剂脱汞性能优于醋酸锰浸渍催化剂的主要原因。较低负载量下，前驱体对脱汞效率的影响较大；随着负载量的增加，其差异逐渐缩小。MnOx/Al2O3催化剂的最佳反应温度和煅烧温度分别为150 ℃和400 ℃。烟气中的O2能够补充催化剂消耗的晶格氧，促进Hg 0的催化氧化；NO，SO2和H2O均对脱汞产生抑制作用，其中SO2的抑制作用最大，H2O次之，NO最小。

关键词： MnOx/Al2O3；催化氧化；单质汞；前驱体；低温

Removal of elemental mercury from flue gas by supported MnOx/Al2O3 catalyst at low temperature

Abstract:

Aiming at the difficulty of Hg0 removal from flue gas with its indissolubility in water，a series of studies on the characteristics of elemental mercury (Hg0) catalytic oxidation removal from simulated flue gas were carried out with a laboratory-scale fixed-bed reactor using the MnOx/Al2O3 catalysts prepared by the wet impregnation method.The effects of precursor，MnOx content，calcination temperature，reaction temperature and flue gas compositions on the removal of Hg0 were also investigated.The characteristics of the catalysts were analyzed using the method of nitrogen adsorption/desorption，scanning electron microscope (SEM)，and X-ray diffraction (XRD).The result shows that the catalyst prepared with manganese nitrate exhibits a higher Hg0 removal efficiency than the catalyst prepared with manganese acetate.The main active component of the MnOx/Al2O3 catalyst is MnO2，and the surface morphology and species form of MnOx are the main factors for getting an excellent Hg0 removal efficiency.The mercury removal results indicate that at low MnOx content，the precursor shows great impact on mercury removal，while the difference of Hg0 capture efficiency gradually decreases with the increase of MnOx loading.For the MnOx/Al2O3 catalyst，the optimal reaction temperature and calcination temperature are 150 ℃ and 400 ℃，respectively.The oxygen from the flue gas，which replenishes the lattice oxygen of the catalyst consumed，can promote the catalytic oxidation of Hg0.To some extent，the NO，SO2 and H2O displays inhibitory effects on Hg0 removal.The influence of SO2 is the highest，followed by H2O and NO.

Keywords: MnOx/Al2O3；catalytic oxidation；elemental mercury；precursor；low temperature

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