Development of catalytic combustion-type monitoring devices of diesel particulate matter

阮，宏程

https://hdl.handle.net/2324/1866332

出版情報：九州大学，2017，博士（工学），課程博士
バージョン：

Abstract of thesis

A series of Ag-supported catalysts (Ag/HZSM-5, Ag/TiO_2, Ag/α-Al_2O_3, Ag/CeO_2 and Ag/SiO_2) were synthesized by the impregnation method. These catalysts materials were characterised by the X-ray diffraction, High temperature X-ray diffraction, scanning electron microscope, X-ray photoelectron spectroscopy, scanning transmission electron microscopy, Diffuse Reflectance Infrared Fourier Transform spectroscopy and so on. On one hand, the soot oxidation activities with these catalysts were conducted by the TG-DTA measurements. Ag/HZSM-5 and Ag/TiO_2 exhibit a better catalytic activities in tight contact (TC) mode than the others, but not good in LC mode for Ag/HZSM-5 (890) catalyst. The Ag/HZSM-5 (890) shows the best CB oxidation activity when the Ag content is fixed at 4.5 wt.%. The chemical state of Ag species in Ag/HZSM-5 (Si/Al = 1500) were examined by the in-situ X-ray absorption spectroscopy measurements during the soot combustion process. Two kinds of Ag species (Ag^0 and Ag^+) were found in this catalyst. The metallic Ag (Ag^0) works as the active species for soot oxidation and exhibits high catalytic activity. These metallic Ag nanoparticles show high thermal stability, which are stable from 250 to 600 ^oC. Moreover, cationic Ag are reduced to metallic Ag at around 250 ^oC but appears again due to the ion exchange interaction with the OH groups on the surface of HZSM-5 at above 600 ^oC. On the other hand, the sensor performance with Ag/TiO_2, Ag/α-Al_2O_3 and Ag/CeO_2 catalysts were investigated by the combustion-type sensor. The catalyst with the high intrinsic CB oxidation activity improves the response property at an initial oxidation. Furthermore, the effects of thermal conductivity of catalyst materials were discussed in our thesis. We found the thermal conductivity of catalyst materials has a significant effects on the soot sensing performance.