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# Selective Catalytic Reduction of NO with $NH_3$ over $CeO_2$-$ZrO_2$-$WO_3$ Catalysts Prepared by Different Methods

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**Abstract:** The selective catalytic reduction (SCR) of NO by $NH_3$ has been investigated over the $CeO_2$-$ZrO_2$-$WO_3$ (CZW) catalysts prepared by hydrothermal synthesis, incipient impregnation, co-precipitation and sol-gel methods. The results indicate that the CZW catalyst prepared by hydrothermal method shows the best SCR activity, and more than 90% NO conversion is obtained at 195-450 °C with a gas hourly space velocity of 50,000 $h^{-1}$. The samples were characterized by XRD, $N_2$ adsorption-desorption, SEM, EDS, XPS, $H_2$-TPR, $NH_3$-TPD and Pyridine-IR techniques. The results imply that the superior SCR activity of CZW catalyst is contributed to the excellent redox property, strong acidity and highest content of chemisorbed oxygen species. Furthermore, the larger surface area and the greater total pore volume improve the redox ability and enhance NO conversion at low temperature, while the co-existence of Lewis and Brønsted acid sites enhance the SCR activity at high temperature.

**Keyword:** hydrothermal method; $CeO_2$-$ZrO_2$-$WO_3$; chemisorbed oxygen; acidity; redox property

## 1 Introduction

Nitrogen oxides ($NO_x$) from diesel exhaust gases contribute to acid rain, ozone depletion, greenhouse effect and photochemical smog [1]. The abatement of nitrogen oxides ($NO_x$: NO > 95%, $NO_2$) has become one of the greatest challenges in environmental protection. Selective catalytic reduction (SCR) of NO with $NH_3$ is one of the most efficient technologies for removing of NO [2]. The commercial SCR