THE MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
NATIONAL RESEARCH TOMSK STATE UNIVERSITY

CATALYSIS: FROM SCIENCE TO INDUSTRY

Proceedings of
VII International scientific school-conference for young scientists

October 11-15, 2022

Tomsk 2022

Study of Ag catalysts on Ce-Mn oxide for post-treatment of exhaust gases: state of the art and perspectives

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Nowadays, NO_x emissions remain the main problem of diesel engines [1]. The catalytic removal of NO_x ($DeNO_x$) can be performed using different technologies with advantages and disadvantages. Among the various methods, however, the one that is of greatest interest is the SCR (Selective catalytic reduction) system, in which the use of gas oil or hydrocarbons (HC)/oxygenated hydrocarbons, unburnt alcohols (HCO) as reducing agents, simplify the system and reduce costs, making these systems of particular interest, thanks, also, excellent performance of reducing and eliminating NO_x emissions from the exhaust diesel engine [2, 3]. In this study the role of Ag and Ag-Pt supported catalysts on oxides such as CeO_2, MnO_2 and mixed oxide such as $CeMnO_x$ was investigated in the selective catalytic reduction of NO_x [4, 5] using propene (C_3H_6) as reducing agents [3]. All the oxides, CeO_2, MnO_2 and $CeMnO_x$ (with molar ratio Ce/Mn = 1) were synthesized with the sol-gel method, using citric acid as a chelating agent (citrate method). The supports thus obtained were impregnated with aqueous solutions of $[Ag(NH_3)_2]NO_3$, in order to obtain catalysts with Ag loads of 1% and 0.5% by weight; while the bimetallic catalysts (Ag-Pt) containing 0.5 wt.% of Pt were prepared by impregnating the supports with acetone solutions of the precursor Pt $(Me_4N)_2[Pt_2(\mu\text{-}OH)_2(NO_3)_8]$). The calcination of the oxides was carried out at 500 °C for 3 hours, while the catalysts with Ag-Pt were calcined in air at 500 °C for 2 hours. To estimate the activity of NO SCR and the effects of the Ag and Pt, catalytic tests were performed using propene for HC-SCR, with a mixture composed of 1000 ppm in NO, 3600 ppm C_3H_6, 10 vol.% in O_2, 2.9 vol.% H_2 and He as balance gas, at WHSV of 25,000 ml g^{-1} h^{-1}. The physiochemical properties of the catalysts were obtained by several characterizations, such as XRD, XPS, H_2-TPR, N_2-physisorption and Raman spectroscopy.

This work was financially supported by the Ministry for Science and Education of the Russian Federation (Project No. 075-15-2021-1388) and by the Italian Ministry of Foreign Affairs and International Cooperation" ("Progettazione di Catalizzatori Attivi a base di Ag-Pt depositati su Ce e Mn modificati con Y per il Post-Trattamento dei Gas di Scarico emessi dai Motori Diesel" Prot. MAE01538512021-10-26).

References

1. Reşitoglu, I. A.; Altinişik, K.; Keskin, A. *Clean Technol. Environ. Policy* **2015**, *17*(1), 15–27.
2. Burch, R.; Breen, J.P.; Meunier, F. C. *Appl. Catal. B* **2002**, *39*(4), 283–303.
3. Mrad, R.; Aissat, A.; Cousin, R.; Courcot, D.; Siffert, S. *Appl. Catal. A* **2015**, *504*, 542–548.
4. Yang, C.; Yang, J.; Jiao, Q.; Zhao, D.; Zhang, Y.; Liu, L.; Hu, G.; Li, J. *Ceram. Int.* **2020**, *46*(4), 4394–4401.
5. Wang, C.; Yu, F.; Zhu, M.; Tang, C.; Zhang, K.; Zhao, D.; Dong, L.; Dai B. *J. Environ. Sci.* **2019**, *75*, 124–135.