Selective Catalytic Reduction of NOx using Hydrocarbon

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Award of Degree

Doctor of Philosophy

By

Deepak Yadav

DEPARTMENT OF CHEMICAL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY
(BANARAS HINDU UNIVERSITY)
VARANASI- 221005

Roll No. 13041001

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CHAPTER – 6

CONCLUSIONS

AND

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CONCLUSIONS

Based on the experimental results and discussion following conclusions can be drawn:

- Spinel catalysts ($MnCo_2O_4$, $CuCo_2O_4$, $NiCo_2O_4$) are prepared by different methods (CP, NC, DCP) for comparative studies of SCR of NO using H_2-C_3H_8 reductant.
- The order of preparation methods of the catalysts for NO reduction activity was as follows: NC ≈ DCP > CP.
- The order of calcination strategies of catalyst precursors for SCR of NO activity was as follows: RC > FA > SA.
- The order of unsupported catalyst based on activity for the reaction follows the following trend: $MnCo_2O_4$ > $CuCo_2O_4$ > $NiCo_2O_4$.
- The optimum loading of $MnCo_2O_4$ on γ-Al_2O_3 is 32%.
- The performance order of promoted and supported catalysts for SCR of NO using H_2 assisted C_3H_8 is as follows: 0.2%Rh32%$MnCo_2O_4$/γ-Al_2O_3 > 0.3%Rh32%$MnCo_2O_4$/γ-Al_2O_3 > 0.1%Rh.32%$MnCo_2O_4$/γ-Al_2O_3.
- The catalyst formulation, 0.2%Rh32%$MnCo_2O_4$/γ-Al_2O_3 (Cat-K) prepared by DCP followed by RC route of calcination shows the best NO-SCR performance with H_2-C_3H_8 reductant, 98.8% NO conversion was achieved at 147ºC.
- The kinetics of NO-SCR over Cat-K is 1st order w.r.t. NO and the value of activation energy is found to be 93.82 kJ/gm mol and the rate of NO reduction is given by rate: $(-r_P) = 14.78 \times 10^{10} \exp(-93820/RT)(C_{NO})$ gm mol/gm cat-h.

- H_2-LPG (~72% C_3H_8) was used as reductant showed comparable SCR performance of NO to H_2-C_3H_8. Therefore, with so many advantages of LPG, it is suggested to be used as reductant for SCR of NOx from vehicular exhaust. Care should be taken to eliminate mercaptane content of LPG to prevent deactivation of the catalyst. The mercaptane content in LPG is ~ 30 ppm. Therefore, the feed stream containing LPG reductant should be made free of mercaptane by bubbling it through a solution of sodium plumbite.

• FUTURE SCOPE

- There are more than hundreds of publication on C_3H_8 reductant for SCR of NO. A typical composition of LPG (74.23% C_3H_8, 13.03% n-C_4H_{10}, 12.19% i-C_4H_{10} and 0.55% C_2H_6) used as reductant shows comparable SCR performance of NO to C_3H_8. Therefore, with so many advantages of LPG, it is suggested for future applications.
- Kinetics studies for SCR of NO using LPG reductant should be performed.
- Effect of water vapours and SO_2 deactivation can be studied on the catalyst, in order to commercialize it for lean burn diesel NOx abatement.