Selective Catalytic Reduction of NO\textsubscript{x} with Diesel-Based Fuels as Reductants
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Overview
We have reported the development of bifunctional catalysts based on metal-exchange zeolites coated with metal oxide phases at the nanoscale level [1, 2]. In the case of JP-8, the application of the oxide coating lowers the NO reduction temperature by approximately 150°C and (pre-reduced) catalysts shows higher activity under wet feeds. Results of deNO\textsubscript{x} studies over this catalyst using middle-distillate fuels as reductants are presented here.

Diesel Activity
Choice of Fuel

Diesel Activity
Catalyst Prefers Wet vs. Dry

Catalyst Preparation
To produce a nanoscale coating on the zeolite crystals, a nanoparticle ceria sol is added to partially exchanged Cu-ZSM-5 crystals by impregnation in ethanol. The sol is absorbed by the zeolite inner pores, while the cerium oxide nanoparticles agglomerate on the external surface of the crystals. Most of the absorbed water is removed by drying the crystals at 150°C, and the sol stabilizer (acetate) is removed by calcination at 500°C.

Ceria loadings varied from 1% to 25% (w/w).

Catalyst Selectivity
Minimal Formation of Side Products
Side Product Formation under Wet Conditions (300°C)

Catalyst Selectivity
Minimal Formation of Side Products
CO Conversion
NO\textsubscript{2} Selectivity
CO Selectivity
C\textsubscript{2}H\textsubscript{6} Slippage

Effect of Ceria Content

Effect of Oxygen on HC-SCR

Effect of Steaming

Optimization
Preparation Method of Coating Affects Activity
Hydrothermal Stabilization

Conclusions
The CeO\textsubscript{2}/Cu-ZSM-5 system shows significant activity for NO to N\textsubscript{2} conversion when kerosene fuels are used as reductants. The system offers:
- A stable temperature window of activity.
- Water-stabilized activity.
- CO tolerance.
- Tunable CeO\textsubscript{2} content for specific applications.

References

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