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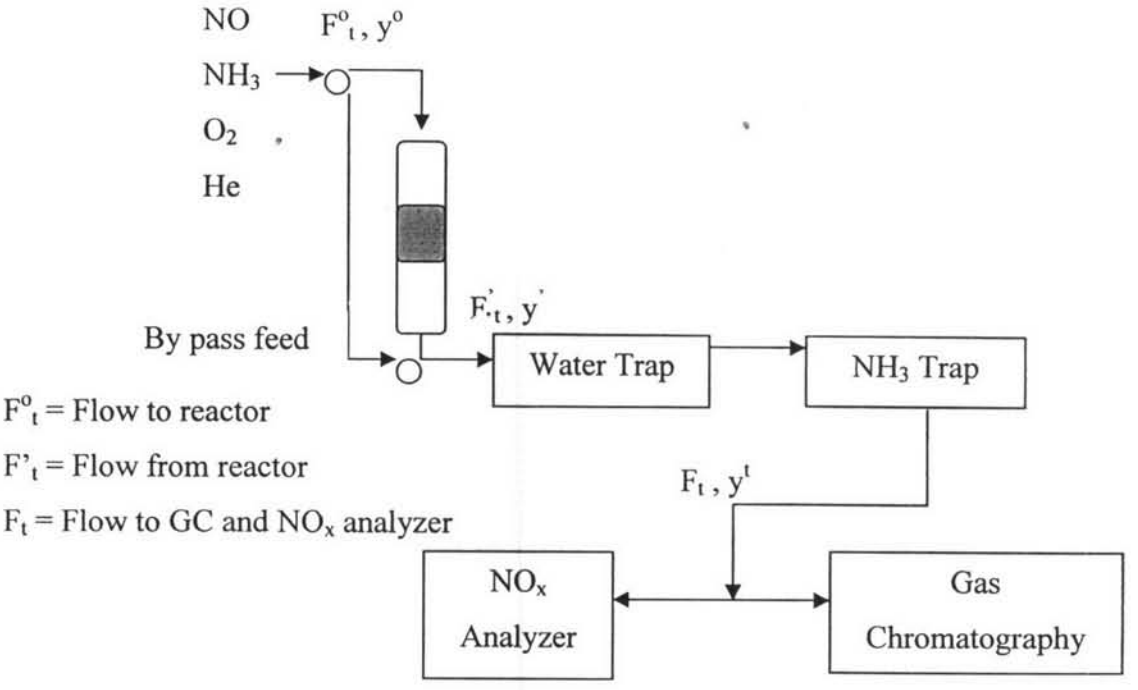
APPENDICES

Appendix A Calculation of NO Conversion and N_2/N_2O Selectivity



F^o_t = Flow to reactor

F'_t = Flow from reactor

F_t = Flow to GC and NO_x analyzer

1. <u>NO Conversion</u>

$$\text{NO Conversion} = \frac{y^0_{NO} F^0_t - y'_{NO} F_t}{y^0_{NO} F^0_t}$$

2. <u>Volume Fraction of N_2O</u>

Volume Fraction of N_2O in the product stream can be determined by atomic oxygen (O) balance:

O balance;

In reactor = Out reactor

$$2y^O_{O_2} F^0_t + y^O_{NO} F^0_t + 2y^O_{NO_2} F^0_t = 2y'_{O_2} F_t + y'_{NO} F_t + 2y'_{NO_2} F_t + y'_{H_2O} F'_t + y'_{N_2O} F_t$$

$$y'_{N_2O} = \frac{1}{F_t}[2y^O_{O_2} F^0_t + y^O_{NO} F^0_t + 2y^O_{NO_2} F^0_t - y'_{H_2O} F'_t] - [2y'_{O_2} + y'_{NO} + 2y'_{NO_2}]$$

3. Volume Fraction of H_2O

Water produced per run = A g

Running time = t min

Volume of water produced = $\frac{\text{A g} \times 0.0821\ \text{L/mol K} \times 298.15\ \text{K}}{18 g/mol \times 1 atm}$

= B liter

Volume of water produced per min = $\frac{\text{B liter} \times 1000\ \text{ml}}{t\ \text{min}}$

= V ml/s

Y_{H2O} = V/F'

4. N_2/N_2O Selectivity

N_2/N_2O Selectivity = $\frac{y'_{N_2}}{y'_{N_2} - y'_{N_2O}}$

Appendix B Raw Data

Table B1 Arrangement of catalysts in terms of (a) acidity, and (b) acid strength

NO	Catalyst	Area
1	ITQ-21/H-MOR	52790000
2	H-MOR	44560000
3	Ni/ITQ-21/H-MOR	37390000
4	Co/ITQ-21/H-MOR	36070000
5	Fe/ITQ-21/H-MOR	32860000
6	Ni/MOR	30690000
7	Co/MOR	20890000
8	Fe/MOR	19660000
9	Cu/ITQ-21/H-MOR	9375000
10	Cu/MOR	5927000

(a)

NO	Catalyst	R_{time} (min)
1	Cu/ITQ-21/H-MOR	7.03
2	Cu/MOR	8.16
3	H-MOR	8.22
4	Fe/MOR	8.33
5	Co/MOR	8.37
6	ITQ-21/H-MOR	8.46
7	Co/ITQ-21/H-MOR	8.51
8	Fe/ITQ-21/H-MOR	8.59
9	Ni/MOR	9.00
10	Ni/ITQ-21/H-MOR	9.22

(b)

Table B2 SCR Activity Test of 0.1 g of 5%Co/MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	9.30%	98.05%
300	19.38%	97.43%
350	29.20%	97.63%
400	38.52%	97.22%

Table B3 SCR Activity Test of 0.1 g of 5%Co/ITQ-21/H-MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	72.43%	94.27%
300	72.83%	91.93%
350	74.21%	92.20%
400	76.49%	92.79%

Table B4 SCR Activity Test of 0.1 g of 5%Cu/MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	63.31%	99.26%
300	86.04%	99.18%
350	83.19%	98.94%
400	78.65%	98.84%

Table B5 SCR Activity Test of 0.1 g of 5%Cu/ITQ-21/H-MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	71.22%	99.62%
300	91.95%	99.33%
350	89.08%	99.11%
400	84.51%	98.95%

Table B6 SCR Activity Test of 0.1 g of 5%Fe/MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	8.59%	98.76%
300	31.32%	98.69%
350	48.58%	98.87%
400	70.44%	98.80%

Table B7 SCR Activity Test of 0.1 g of 5%Fe/ITQ-21/H-MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	59.96%	95.34%
300	76.74%	97.03%
350	91.82%	97.43%
400	93.98%	97.28%

Table B8 SCR Activity Test of 0.1 g of 5%Ge/MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	6.69%	98.60%
300	12.97%	98.64%
350	14.13%	98.73%
400	7.67%	98.01%

Table B9 SCR Activity Test of 0.1 g of 5%Ni/MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	7.72%	98.97%
300	9.72%	98.58%
350	12.61%	98.28%
400	18.13%	98.41%

Table B10 SCR Activity Test of 0.1 g of 5%Ni/ITQ-21/H-MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	24.27%	96.71%
300	27.85%	96.17%
350	29.23%	96.36%
400	32.29%	96.39%

Table B11 SCR Activity Test of 0.1 g of H-MOR

Temperature (C)	NO Conversion (%)	N_2/N_2OSelectivity (%)
250	9.15%	98.57%
300	10.35%	98.03%
350	5.84%	97.94%
400	8.89%	98.14%

Table B12 SCR Activity Test of 0.1 g of ITQ-21/H-MOR

Temperature (C)	NO Conversion (%)	N2/N2OSelectivity (%)
250	2.06%	99.56%
300	7.63%	99.65%
350	7.31%	99.24%
400	9.11%	99.28%

Appendix C Metal Crystal Size Calculation from XRD

Metal crystal size calculation (XRD)

Scherrer's equation Db=(K*λ)/(B*Cos (Θ))

K 0.9
λ 0.154056 nm

Metals	Support	2Θ	FWHM(°)	Θ	B	Crystal Size (nm)
Co	MOR	44.40	0.094	0.38762	0.0016	91.2470
Ni	MOR	44.44	0.118	0.38797	0.0021	72.6986
Fe	MOR	44.16	0.094	0.38552	0.0016	91.1692
Cu	MOR	43.74	0.118	0.38186	0.0021	72.5189

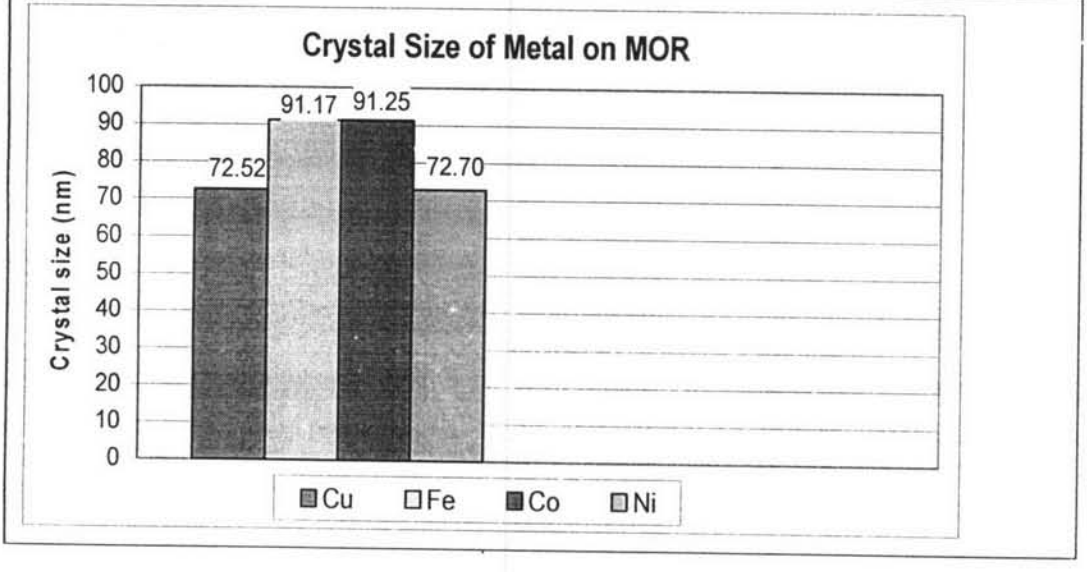


Figure C1 Crystal size of reduced metals calculated from XRD.

From the calculation of metal crystal size, it was found that the metal size did not affect on SCR activities.

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