CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

1. There are no significant differences between Cu/Na-ZSM-5 and Cu/H-ZSM-5 in structure, surface area, coke formation and acid properties. However, in the same total Cu content of both Cu/Na-ZSM-5 and Cu/H-ZSM-5, Cu/H-ZSM-5 has more Cu^{1+} than Cu/Na-ZSM-5.

2. From the steady state and transient experiments, the activities of Na, H-ZSM-5, Cu/Na-ZSM-5 and Cu/H-ZSM-5 on NO conversion and possible reactions taking part in the mechanism are summarized in Table 6.1.

Table 6.1 Activity of catalysts on various reactions

Sample / Reaction	Na-ZSM-5	H-ZSM-5	Cu/Na-ZSM-5	Cu/H-ZSM-5
NO	Not active	Not active	Fairly active	Fairly active
$NO + O_2$	Little active	Quite active	Very active	Very active
$C_3H_8 + O_2$	Little active	Very active	Very active	Very active
$NO + C_3H_8 + O_2$	Little active	Very active	Very active	Very active
$NO + C_3H_8$	-	-	Fairly active	Quite active

*   Not active < Little active < Fairly active < Quite active < Very active

3. From the result that H-ZSM-5 is not active in NO decomposition but active in NO oxidation, it is likely that oxygen preferably adsorbs on H-ZSM-5 and then reacts with NO in the gas phase to form NO_2. This route differs from the oxidation on the copper site.

4. Cu/Na-ZSM-5 is slightly more active than Cu/H-ZSM-5 in NO conversion in the presence of oxygen whereas Cu/H-ZSM-5 is more active in NO conversion in the absence of oxygen. The different acitivities between Cu/Na-ZSM-5 and Cu/H-ZSM-5 might be due to the different residual cations and/or to Cu^{1+}/Cu^{2+} ratio on catalysts surface.

6.2 Recommendations

1. Further study in detail of the state of copper species on the surface of ZSM-5. Also identification of difference on Cu/H-ZSM-5 and Cu/Na-ZSM-5.

2. Studies of activities and characteristics of catalysts with different Cu loading

3. Adsorption characteristic on acid sites and copper sites by using such as TPD technique.

4. Application of other methods such as modulation or different step changes including step down.