CHAPTER I

INTRODUCTION

The increasing volumes of air pollutants such as carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x), sulphur dioxide (SO_2), particles, and soot have become a serious global problem that must be solved as soon as possible. Beside these emissions, the increasing carbon dioxide (CO_2) concentration in the atmosphere and its contribution to the greenhouse effect is also of general concern. The main contribution to the man-made CO_2 emission is due to combustion process in power plans, industries, and transportation systems.

The world demands greater efficiencies in transportation but without the harmful effect of increased pollution. The gasoline fueled automobile is a great luxury for the average citizen of the world, but it is a large fossil fuel consumer, and it directly generates enormous amount of emissions. Therefore, the development of internal combustion engines with improved fuel economy is of social interest. The three-way catalytic converter (TWC) [1] is efficient in the simultaneous reduction of CO, HC, and NO_x. However, it requires an exhaust gas composition operating very close to the stoichiometric point, i.e. the point that there is sufficient but not excess O_2 for reacting with CO and HC. The operation of the gasoline engine with a lean air-to fuel ratio results in a decrease in fuel consumption, and less generation of CO_2, but the TWC cannot reduce NO_x in this condition.

The most attractive method for the removal of NO_x is the catalytic decomposition of NO [2-4], because no reducing agent is required Because NO is thermodynamically unstable relative to N_2 and O_2 [5]. this method is feasible. However, no suitable catalyst with a significant activity in real exhaust gas has been identified. It is widely accepted that the poisoning of the catalyst surface by oxygen from the exhaust gas or from the decomposition itself is the main problem. Therefore, up to now the only way to reduce NO_x emission in lean exhaust gas is the injection of reducing agents into the exhaust gas stream [6-10].

For a power plant or a stationary diesel engine, the selective catalytic reduction of NO by infection of ammonia into the exhaust gas is well known [6,11,12]. However, the use of NH_3 has reverse disadvantages such as high costs of facilities, and offensive odour during running, and leakage of unreacted dangerous ammonia. For these reasons, the use of ammonia in this process is unsuitable for small scale oxygen-rich NO emissions such as diesel engine exhaust [9]. Thus, an effective NO reduction process with an affordable, non-ammonia reductant is desirable.

Recently, the reduction of nitric oxide with hydrocarbons has also drawn attention as a process for the catalytic removal NO in the exhaust gas of diesel or lean-bun gasoline engines [10-17].Some studies on the NO decomposition in the presence of excess oxygen and a low concentration of hydrocarbons were reported using microporous crystalline metallosilicate such as H-ZSM-5 [10], Cu/ZSM-5 [11], Cu-incorporated zeolite [12], some metallosilicate [13], and metal ion-exchanged zeolite [14-18]. Among the catalysts which have been reported, Cu-ion exchanged ZSM-5 (Cu/ZSM-5) is potentially the most effective catalyst for the reduction of NO with hydrocarbons [19-21]. However, the mechanism of selective NO reduction by hydrocarbons are not clear. Thus, there is a need to find out the real mechanism of this reaction by various methods. In this study, the experiment perform the indirect way to find this mechanism, via investigation of the carbon deposited on surfaces, or call "coke".