

## CHAPTER I

### INTRODUCTION

Coal combustion is found as a source of nitrogen oxide pollution possessing the significant amount of nitric oxide and nitrous oxide. Both nitric oxide (NO) and nitrous oxide (N<sub>2</sub>O) contribute to acidification, global warming, and depletion of the stratospheric ozone layer. Not only have such nitrogen oxides led to the environmental problems, but they can effect on health of human beings as well. NO at room temperature is a colorless, nonflammable, toxic gas. In the presence of air, It forms brown fumes of nitrogen dioxide (NO<sub>2</sub>), which is extremely reactive and a strong oxidizing agent. Like NO, at room temperature and atmospheric pressure N<sub>2</sub>O is a colorless gas with a barely perceptible sweet odor and taste and also nonflammable. Unlike NO, N<sub>2</sub>O does not affect the acidity of water solution while NO itself is non-corrosive except the presence of moisture and oxygen, corrosive conditions will develop as a result of the formation of nitric and nitrous acids.

In addition to effect on the environmental aspects, such nitrogen oxides can also effect on health of human beings. NO, with the attendant formation of NO<sub>2</sub>, results in a strong respiratory irritant which may be fatal. A time-weighted threshold limit value of 25 ppm (30 mg/m<sup>3</sup>) for an eight-hour period has been adopted (Compressed Gas Association, Inc. 1990). For N<sub>2</sub>O, inhalation of N<sub>2</sub>O without the provision of a sufficient oxygen supply may be fatal or cause brain effect and central nervous system (CNS) depression. Limit of 25 ppm measure on an eight-hour time-weighted average basis is recommended. Coal combustion in the fluidized-bed combustor (FBC) which

is one of the few combustion methods yields the considerable emissions of nitrogen oxides. They mainly come from the oxidation of fuel-bound nitrogen. Many approaches are proposed to removal nitrogen oxides. Novel burner and engine design, absorption, and thermal destruction are some of the more straightforward methods that can be used to resolve this increasingly serious environmental problem. The catalytic decomposition of nitrogen oxide into  $N_2$  and  $O_2$  is another way. However, sufficient catalytic activity for decomposition of nitrogen oxides in oxygen-rich atmosphere has not been realized because catalyst is deactivated by oxygen. For this reason, carbon would be a candidate to reduce this problem. The use of carbon as a reducing agent, catalyst, and/or catalyst support offers obvious potential advantages, including very efficient, in situ oxygen scavenging capability, and elimination of the environmentally problematic “slip” of the gaseous reducing agent such as ammonia (Illán-Gómez *et al.*, 1996).

The kinetics of the reduction of NO and  $N_2O$  by carbon has been extensively studied by many researchers. In general the reaction rates were determined based on a basis of mass or surface area unit. However, it was indicated that edge atoms on carbon surfaces are active sites for gasification (Chen and Yang, 1993). Thus, the reactivity should be considered based upon the actual active surface area rather than the total surface area.

In this present study, a pure graphite used as a carbon material to reduce NO and  $N_2O$  was well-defined crystal dimensions and the edge surface area can be determined by the geometry. The kinetics of graphite gasification by NO or  $N_2O$  were studied in a thermogravimetric system by isothermal technique. The reactivities of graphite were determined in terms of turnover frequency (TOF), that is, the reaction rate based on per active sites.