

CHAPTER I

INTRODUCTION

The emission of nitric oxide (NO) from fossil fuel combustion has been a problem of considerable interest from an environmental point of view. The burning of fossil fuels for generation of steam, heat, electricity and for general industrial activities contributed about as much nitric oxide to the atmosphere as that from traffic. Nitric oxide in the atmosphere can lead to the formation of photochemical smog; it can contribute to acid rain problems; and it is suspected to play a role in the depletion of stratospheric ozone.

Nitric oxide at room temperature is a colorless, nonflammable, toxic gas. In the presence of air, it forms brown fumes of nitrogen dioxide (NO₂), which is extremely reactive and a strong oxidizing agent. Nitric oxide has harmful effects on health. It results in a strong respiratory irritant which may be fatal. A time-weighted threshold limit value of 25 ppm (30 mg/m³) for an eight-hour period has been adopted (Compressed Gas Association, Inc., 1990).

NO emission can be controlled by various methods of combustion control or by a variety of flue gas treatments such as catalytic converter, activated carbon as an adsorbent, etc.

In coal combustion process, it was recognized that NO formed during coal combustion can subsequently react with carbon to produce N₂. Therefore the possible way of reducing nitric oxide is the use of carbon to convert NO to CO or CO₂ (C-NO reaction). There are many studies also in which the use of carbon as reducing agents in combination with various kinds of catalytic promoters has been studied (Illan-Gomez et al., 1996).

The kinetics of the reduction of NO by carbon has been studied by many researchers. In general the reaction rates were determined based on a basis of mass or surface area unit. Actually only edge sites on the carbon are the active sites for carbon gasification reaction (Yang et al., 1993). Thus the reactivity should be performed relative to actual active surface area, rather than total surface area. There is substantial evidence of the often-reported "break", in the Arrhenius plot, whereas the activation energy of the reaction process increases as temperature being raised beyond a certain threshold. However, there is as yet no clear understanding of what determines this.

In this study, two types of pure graphites which were well-defined crystal dimensions were used. Their edge plane surface areas were calculated from the geometry. The kinetics of the NO-graphite reaction in the turnover frequency (TOF), the rate based on per active site, was studied and the temperature break in Arrhenius plots was also determined.