

A STUDY OF NITROGEN OXIDE CONCENTRATIONS DURING ARC WELDING

LESLIE SILVERMAN, Sc.D. (Indust. Hyg.)

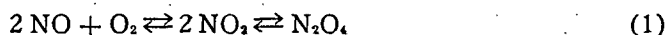
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S. I. HUSAIN, S.M.

BOSTON

NITROGEN oxide concentrations have been of interest to industrial hygienists for several years. As each improvement has developed in the arc welding process, it has been important to determine its effect on fume and nitrogen oxide concentrations in the ambient atmosphere of the welding operation.

Our interest in this problem was aroused by the recent discussion presented by Elkins.¹ Using theoretical considerations, he predicted the rate of formation of nitrogen dioxide (NO_2) from nitric oxide (NO) during welding. This reaction, described by many investigators, is assumed to be as follows:



The rate of formation of NO_2 can be obtained from the following rate equation:

$$\frac{d}{dt} [\text{NO}_2] = K [\text{O}_2] [\text{NO}]^2 \quad (2)$$

Elkins calculated the rate of formation of NO_2 with various concentrations of NO and observed that NO might be converted to significant amounts of NO_2 in welding atmospheres. The basis for these calculations may be correct for kinetic oxidation of NO in nitrometer operations, or similar situations, where only NO is present.² However, several factors exist in welding operations which may influence the amounts of NO_2 formed in the ambient atmosphere. These factors are discussed below.

From the Department of Industrial Hygiene, Harvard School of Public Health, Boston.

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Mr. Husain was a student in the Graduate School of Engineering, Harvard University, 1947-1949. His present address is: 4-C Zaildar Park, Ferozepur Road, Lahore, Pakistan.

1. Elkins, H. B.: Nitrogen Oxide-Rate of Oxidation of Nitric Oxide and Its Bearing on the Nitrogen Dioxide Content of Electric Arc Fumes, *J. Indust. Hyg. & Toxicol.* **28**:37, 1946.

2. Since this paper was presented, H. A. Wade, H. B. Elkins and B. P. W. Ruotolo have published the results of various field studies on NO_2 -total oxide relationships. (Composition of Nitrous Fumes from Industrial Processes, *J. Indust. Hyg. & Occup. Med.* **1**:81 [Jan.] 1950). Work by J. H. Smith, (A Photo-Colorimetric Study of the Oxidation of Nitric Oxide at Low Pressures, *J. Am. Chem. Soc.* **65**:74, 1943) indicates that the value of the rate constant K should be approximately half that used by Elkins,¹ which was based on early work by Bodenstein. This correction would reduce the nitrogen dioxide formation rate predicted by the termolecular reaction.