Harris and Siegel [3] reported that nitrogen dioxide is dissociated by ultraviolet radiation according to the reactions given below.

$$2\,NO_2 + h_\nu \rightarrow 2\,NO + O_2 \qquad (3)$$

The primary dissociation is believed to be as follows:

$$NO_2 + h_\nu\ (3900 - 2600\ \text{Å}) \rightarrow NO + (^3P)O \qquad (4)$$

and also

$$NO_2 + H_\nu\ (\lambda < 2460\ \text{Å}) \rightarrow NO + (^1P)O \qquad (5)$$

Normal oxygen atoms (^3P) or excited oxygen atoms (^1P) are obtained, depending on the wavelength of the ultraviolet rays irradiating NO_2. Ultraviolet radiation is present in the welding arc and may influence the state of gases formed there. It is possible that during welding NO_2 formed near the zone of effective radiation may be reduced to NO. In the region of the welding arc, then, it is unlikely that NO will form NO_2 at rates predicted by the kinetic equations.

The reactions presented by Harris and Siegel are further complicated by the fact that oxygen atoms produced by irradiation react at a fast rate with the nitrogen dioxide present to give a further molecule of nitric oxide as shown by the equation below.

$$NO_2 + O \rightarrow NO + O_2 \qquad (6)$$

In addition to these possibilities, it is known that there are concentrations of ozone present near the welding arc which diminish rapidly as distance from the arc is increased. These concentrations may also influence the oxidation of NO to NO_2 or possibly cause higher oxides to form immediately.

Another factor of significance in the welding atmosphere, which may play an important role in the formation of nitrogen dioxide, is the known fact [4] that in the presence of iron and moisture nitric oxide is changed to nitrous oxide (N_2O) as given by the equations below

$$2\,NO + Fe + H_2O \rightarrow N_2O + Fe(OH)_2 \qquad (7)$$

Ammonia may also be produced by moist iron filings and NO. Further breakdown may result since

$$Fe + NO \rightarrow N_2 + \text{iron oxides} \qquad (8)$$

Iron exists in the welding atmosphere in a finely divided form with large surface area and may readily enter into these reactions. There is a possibility that a large part of the nitrous oxide formed may be broken down to nitrogen and oxygen near the arc, since when nitrous oxide is heated to 565-850 C. the following reaction takes place:

$$2\,N_2O + \Delta \rightarrow 2\,N_2 + O_2 \qquad (9)$$

Another factor may also alter the composition of nitrogen oxide in the arc welding zone, since freshly formed iron fume is a highly reactive and absorbent medium. Reaction may take place between the oxides and iron fume and convert these in part to particulate nitrates and nitrites. This will reduce the amount of gaseous oxides appearing in the atmosphere. In general it has been found that hot metals decompose nitric oxide forming the metal oxide and nitrogen.

3. Harris, L., and Siegel, B. M.: Reactions of Nitrogen Dioxide with Other Gases, J. Am. Chem. Soc. **63**:2520, 1941.

4. Priestley discovered nitrous oxide (N_2O) in 1772 when experimenting with the action of moist iron filings on nitric oxide.