



## ELECTROMETRIC STUDIES OF OXIDE FILMS ON IRON AND COPPER\*

H. A. Miley, *Stillwater, Oklahoma*

(Abstract)

At Cambridge University (with Dr. U. R. Evans, 1935-37) the author developed an electrical method of measuring film thicknesses, and studied the growth of oxide films on iron and copper at ordinary and several higher temperatures. The method requires that the time be observed for the cathodic reduction of a film by a constant current, and from the millicoulombs thus obtained and the surface area, the thickness is calculated by means of one of Faraday's laws.

The electrometric method is being used to measure tarnish films on some common metals even when the films contain mixtures of two or more substances, such as oxides and sulphides; each component part being measured at a different potential value during a reduction experiment. These complex tarnish films, particularly those on copper and silver, have been of much scientific and commercial concern, but before this method was developed there was no satisfactory quantitative approach by which to study them.

Oxide films formed on the surface of metals, such as stainless steel, often confer a considerable measure of protection against corrosive agencies. Much more research should be directed toward increasing this natural protection of metals as a needed aid to paints and other means of artificial protection.

1. H. A. Miley, "The Thickness of Oxide Films on Iron." *Iron and Steel Inst., Carnegie Scholarship Memoirs* 25, 197 (1936).
2. U. R. Evans and H. A. Miley, "Measurements of Oxide Films on Copper and Iron," *Nature* 139, 263 (1937).
3. H. A. Miley, "Iron Oxide Films," *Metallurgist* pp. 25, 37 (1937).
4. H. A. Miley and U. R. Evans, "The Rate of Growth of Oxide Films on Iron," *J. Chem. Soc.* p. 1295 (1937).
5. H. A. Miley, "Copper Oxide Films," *J. Amer. Chem. Soc.* 59, 2626 (1937).
6. H. A. Miley and U. R. Evans, "Summary of Work at Cambridge University on the Electrometric Study of the Growth of Oxide Films on Iron." *J. Iron and Steel Inst., Fifth Corrosion Report, Section D, p. 243, 1938.*

\*A review was given of research carried out as a Carnegie research scholar at Cambridge University, and published as follows: