TRANSIENT VOLTAGE CHANGES PRODUCED IN CORRODING METALS AND ALLOYS

Warren P. Iverson

Fort Detrick
Frederick, Maryland

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Fort Detrick, Frederick, Maryland

The formation of "hollow whiskers" by the action of slightly acidified potassium ferricyanide and ferrocyanide solutions on metals and alloys appeared to increase in negative charge, the electrons would be removed as a result of oxidation of the anions or neutral species in the solution. During a transient decrease in negative charge on the metal and capacitor plate, the flow of electrons would be from the platinum electrode, as a result of oxidation of the anions or neutral species in solution, to the other capacitor plate, again developing a measurable potential across the resistor. If no change in the charge occurs on the test electrode, no measurable potential is developed across the resistor. This is apparently the case for a noncorroding electrode such as platinum or a less noble metal in the presence of an inhibitor for the initial charge at the capacitor - and the R.C. time constant and inversely related to the electrolyte concentration.

Investigations of these voltage fluctuations appear to offer much promise for the detection and study of the corrosion process. For the study of corrosion inhibitors. Thus far, these fluctuations give a qualitative "fingerprint" characterization of corrosion processes occurring in different metals and alloys. They also offer a very simple way to detect the efficacy of inhibitors, being able to detect corrosion instantaneously.
Fig. 2. Recorder trace of potential fluctuations. Chart speed 3 in/hr. A, Completely immersed platinum electrode (1 x 4.5 cm) in 0.1% NaCl solution; conductivity, 0.22 mhos; platinum electrode 1 cm from completely immersed auxiliary electrode, 25°C. B, Partially immersed (5.5 cm) 1010 steel electrode (1.3 x 18 cm) corroding in 0.1% NaCl solution; electrode 1 cm from completely immersed auxiliary electrode, 25°C. Chart A, electrodes transferred to fresh 0.1% NaCl solution plus 1% NaNO₃; Chart B, electrodes transferred to fresh 0.1% NaCl solution.

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