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KINETICS OF REPASSIVATION OF BARE METAL SURFACES

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Repassivation studies of bare metal surfaces have been investigated by many authors using different methods to generate bare metal surfaces. However, these studies have not been able to yield the *kinetic* parameters involved in the repassivation process.

The present study was undertaken to evaluate the kinetic parameters of the repassivation of bare iron, nickel, mild steel and stainless steel surfaces in 0.05 M $NaHCO_3$ solution at a pH of 8.3. The removal of the oxide film was effected by means of a sapphire point mounted on a moving trolley attached to a specially made perspex electrolytic cell. The experiments were conducted *under potentiostatic* conditions. The resulting current-time transient was recorded on an oscilloscope/recorder and analysed to evaluate the kinetics of the repassivation process. All experiments were carried out in an Argon atmosphere at a temperature of 26 ± 1^0C. Experiments in the first instance were limited to the passive region of the metals.

It is reasonable to assume that the first process involved after the generation of the bare surface is adsorption of water molecules on the surface. This is followed by the film growth and diffusion at longer times. The initial adsorption process is governed by an exponential decay curve. The subsequent film growth follows a model proposed by Fleischmann & Thirsk for instantaneous nucleation and growth. Analysis of current-time transients showed that for a typical value of rate constant $k = 10^{-5}$ mol cm^{-2} s^{-1}, the number of nuclei varied between 1.49×10^{6} - 2.53×10^{6} nuclei cm^{-2} for the metals investigated. This value is very much lower than 10^{15} atom cm^{-2} needed for monolayer coverage thus showing that a single nucleus of the film is covering a large number of surface metal atoms.