

REPASSIVATION STUDIES OF SOME MECHANICALLY DAMAGED
METAL SURFACES

by

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S U M M A R Y

Repassivation studies of four commonly used metals and alloys; iron, nickel, mild steel and stainless steel were carried out in 0.05M, 0.15M and 0.50M NaHCO_3 media at a pH of 8.3. The removal of the oxide film, under potentiostatic conditions was effected by means of a sapphire point mounted on a moving trolley attached to a perspex electrolytic cell. The resulting current time-transient was recorded on an oscilloscope and a strip chart recorder, and analysed to evaluate the kinetics of the repassivation process. The rate of removal of the passive film was $80 \pm 10 \text{ cm s}^{-1}$.

As the metal is exposed the bare surface commences to dissolve, resulting in a current surge. After a brief induction period repassivation begins. The initial repassivation followed the equation

$$I = I_{\text{max}} \exp - \beta t^{1/2}$$

The rate of initial passivation increases with the increase in NaHCO_3 concentration. Further at any given concentration of NaHCO_3 the rate of passivation increases with the increase in anodic potential.

The charges involved in the initial repassivation process which is governed by the above exponential equation, indicate that this process does not lead to a complete coverage of the exposed surface.

A secondary process begins on the same surface after a duration of 500 ms and this process follows the instantaneous nucleation and growth model proposed by Fleischmann and Thirsk. This is attributed to filling of uncovered areas in the adsorbed layer or the formation of another layer on the adsorbed layer.

The film growth is diffusion controlled during the time interval $4s < t < 8s$.