

THE CORROSION BEHAVIOUR OF TITANIUM ELECTRODE (99.99 %) IN ALKALINE SOLUTIONS UNDER CONDITION OF OPEN CIRCUIT

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This paper presents the investigation of rate of anodic oxide film formation on the titanium electrodes (99.99 %) due to the spontaneous oxidation of titanium under condition of open circuit. The corrosion behaviour of the same electrodes, under the same conditions was, also, investigated by cyclic voltammetric method (CV) to obtain the possibility of comparison.¹

The used solutions were 0.1 M NaOH + 1.9 M NaClO₄ and 1.0 M NaOH + 1.0 M NaClO₄. NaClO₄ was used with aim to maintain the constant ionic strength. Oxide layers depth and the growth rate were determined by forced polarization, as well as spontaneous polarization under the open circuit conditions.

It was confirmed that the anodic oxide layers growth rate in 0.1 M NaOH + 1.9 M NaClO₄ using CV method and forced polarization was 2.6 nm/min.

The current consumption for this was 0.0027 C, and it was determined by using the corrosion software in the electrochemical system "PKS".

Under the open circuit conditions, passive oxide layer is formed by spontaneous polarization for 4 hours. That indicated the polarization rate of 0.0054 nm/min. The polarization rate was also determined by CV method on the same way as forced polarization.

The same procedure was carried out in 1.0 M NaOH + 1.0 M NaClO₄ solution with the conclusions that polarization rate obtained by using the forced CV method with the current consumption of 0.0021 C is 2.2 nm/min, but 0.0021 nm/min with spontaneous polarization.

Anodic oxide layer growth rate in 1.0 M NaOH + 1.0 M NaClO₄ is lower

because of the increasing velocity of passive oxide layer of TiO₂ dissolution with increasing content of NaOH in the solution.

Reference:

1. E.J.Kelly, In Modern Aspects of Electrochemistry, (Ed. J.O.M. Bockris, B.E.Conway, R.E.White, No 14, Ch 5, p p. 319-424, Plenum Press, New York (1982))