

SOME ELECTROCHEMICAL PROPERTIES AND CORROSION OF RUTHENIUM BASED DIMENSIONALLY STABLE ANODES

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(Received 16 November 1981)

In order to choose optimum conditions for chlorine evolution on ruthenium based dimensionally stable anodes (DSA) and its acceleration it is essential to know the dependence of the rate of side processes—ruthenium dissolution and oxygen evolution—on the parameters of electrolysis, first of all on the current density as well as on the solution *pH*. On the basis of the kinetic analysis of the regularities of parallel electrode processes and by studying the dependence of the partial rate of the side reactions on the overall current density (Bune *et al.*, 1977), it is possible to establish the kinetics of side reactions and determine the current efficiency of the corresponding side-product formation.

The application of this method to the studies of the kinetics of DSA dissolution and oxygen evolution during chloride electrolysis (300g/l NaCl, 87 °C) showed that the rates of these reactions are described by Tafel plots with slopes equal to 100 and 51mV respectively. Since the main process, i.e., chlorine evolution, is characterized by a lower Tafel slope value ($2.3RT/2F = 36\text{mV}$ at 87 °C) the rates of both side reactions increase with the overall current density much more slowly than the rate of the chlorine evolution. Thus when the overall current density is increased from 0.2 to 1.0Amp/cm² the dissolution of ruthenium decreases by almost 3 times, while the oxygen content in chlorine is halved. Therefore, the increasing of current density allows not only to accelerate the chlorine evolution but to decrease simultaneously the dissolution of ruthenium and the oxygen content in chlorine.

The study of the influence of the solution acidity on the DSA dissolution rate in 300g/l NaCl solution at 0.2 Amp/cm² has shown that in the *pH* range 0.2–3 the dissolution rate practically does not depend on *pH* and is equal to $1 \times 10^{-8}\text{g/cm}^2/\text{hr}$. If the *pH* is raised upto 4 the dissolution rate becomes twice as much as in the lower *pH* range. The rate of oxygen evolution and the current efficiency of this process increases with rise in *pH* from 1.0 to 3.5 by almost two orders of magnitude.

In conclusion it is advisable to conduct the chloride electrolysis with DSA at higher current densities and lower *pH*.

Keywords : Corrosion; Ruthenium; Dimensionally Stable Anodes; Current Density; Tafel Plots

REFERENCE

Bune, N. Ya., Shielaeva, G. A., and Losev, V. V. (1977) *Elektrokhim.*, 13, 1540.