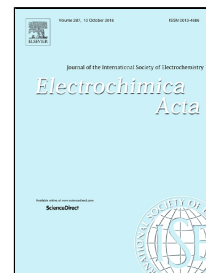


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Galvano- and Potentio-dynamic Studies during Ethanol Electro-oxidation Reaction in Acid vs. Alkaline Media: Energy Dissipation and Blocking Nature of Potassium



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# Galvano– and Potentio–dynamic Studies during Ethanol Electro-oxidation Reaction in Acid vs. Alkaline Media: Energy Dissipation and Blocking Nature of Potassium

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**Abstract.** Despite the net energy yield be the primary goal of ethanol electro-oxidation reaction (EOR), it is never measured in fundamental electrochemical studies. By combining galvanodynamic and potentiodynamic profiles of the steady states of the system, we demonstrate a methodology to estimate the dissipation of chemical energy that allows the inference of the fuel cell power output in relative terms. Apart from the empirical energy dissipation, several kinetic information are unravelled: (a) the kinetics is governed by ethanol adsorption rate for both media and for both external control modes; and (b) either the maximum current sustained by EOR or the steady state currents are, in addition, governed by a global coverage of poisonings species, which includes the contributions from  $\text{CO}_{\text{ad}}$  and non-reactive  $\text{OH}_{\text{ad}}$ . The blocking effect of potassium cations over EOR is clearly verified, reducing the maximum activity up to a factor of 0.19, which is interpreted as an effect of the high coverage of non-reactive  $\text{OH}_{\text{ad}}$ . Finally, it is expected a slightly improvement of the power output of a direct ethanol fuel cell operating at steady state in alkaline media due to the lower chemical dissipation at fixed interfacial current value. Nonetheless, the blocking effect of potassium in alkaline media may, depending on the concentration, either induces an oscillatory regime at higher overvoltage (above 0.57 V) along with the preservation of the energy generation at lower overvoltage or completely decrease the energy generation due to an drastic loss of energy used to polarize the EOR.

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