

Kinetics of the hydrogen evolution on modified nickel electrodes in alkaline solution

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Nickel electrolyzer's cathodes, surface modified with transition metals, such as ruthenium, silver, cobalt, and copper, has been used for the activation of hydrogen evolution reaction (HER) in alkaline media¹⁻³.

Two types of Ni catalysts are studied in this work: Ni electrodes modified by spontaneous deposition of Ru, Cu or Ag, and Ni/Co alloys obtained by electrodeposition.

The first ones were synthesized by immersion of Ni electrodes in the corresponding metal ions solution. Freshly and aged catalysts were analyzed by CV and EIS, and the kinetic and thermodynamic parameters of the HER were obtained. A Langmuir adsorption type was found for fresh and aged catalysts. This behavior is rather different from that found in pure nickel which, after ageing, exhibits a Temkin type adsorption, related to the formation of Ni hydrides. The second type of catalysts, Ni/Co electrodeposited on 316L steel, were analyzed using the same conditions. Ni-Co alloys show the highest current densities, even after aging, indicating that pure Ni electrodes tend to become inactivated with use, and the addition of cobalt would increase the catalyst durability. In summary, Ni modified with transition metals improves the catalytic activity for HER, but only the Ni/Ru and Ni/Cu electrodes exhibit a decrease of the onset potential. HER rate is almost the same on Cu and Ag. Of the catalysts studied here, Ni/Co alloys with low Co content have the highest catalytic activity.

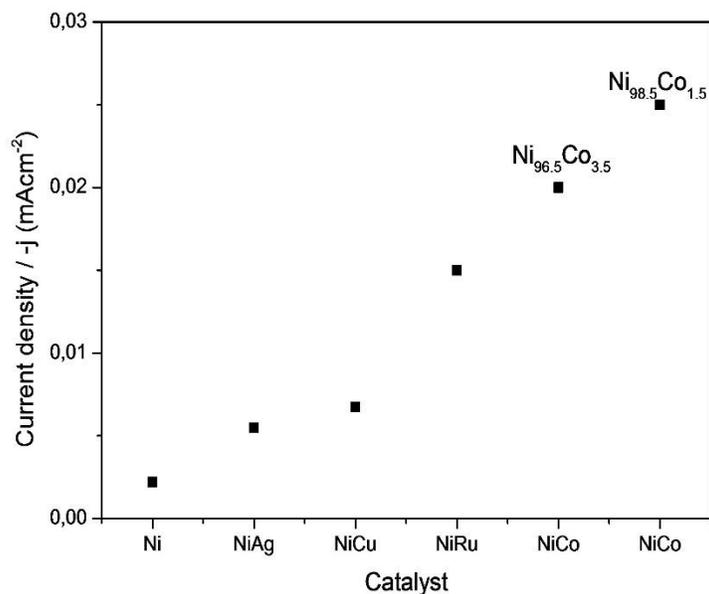


Figure 1: comparison of the current densities measured at 4 hours in 1 M KOH at 25 °C and -1.5 V (vs. SCE). Ni/Co compositions correspond to molar % in the deposition bath.

References:

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