METHANOL ADSORPTION ON NICKEL ELECTRODES

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UDC 541.135.5-183:547

When clarifying the electrooxidation mechanism of organic materials on nickel electrodes one must have information on their adsorption. In [1, 2] it was shown by the method of galvanostatic charging curves that on nickel catalyst electrodes in alkaline solutions, chemisorbed organic products influencing the hydrogen coverage of the electrode surface are not formed by ethylene, methanol, or ethanol. The question remained open whether the organic materials could absorb without displacing hydrogen from the surface.

To answer this question we measured methanol adsorption on Raney nickel catalyst with the radiotracer technique, in the same way as had been done with the platinum electrode [3, 4]. We used labeled methanol with a specific radioactivity of 1.3 mCi/mmole. The specific radioactivity of the working solutions was 0.06 mCi/mmole. Samples of labeled methanol were purified from radiochemical impurities according to the procedure described in [5]. The electrode was a nickel disk to which a surface layer of freshly leached Raney catalyst was applied; the specific surface area of nickel in the catalyst was about 100 m^2/g, the ratio between true and apparent surface area was about 20,000. Methanol adsorption was measured at temperatures of 20 and 70°C over the potential range from 0.05 to 0.14 V (nhe) from 10^{-2} M CH_3OH + 0.1 M KOH solution.

It was found that within the limits of experimental error (10^{12} particles per cm^2 of true surface area), there is no irreversibly adsorbed organic material, i.e., material remaining on the electrode surface when the working electrolyte has been replaced by base electrolyte solution. Nor could we detect any reversibly adsorbed organic material. The measuring error for reversible adsorption was $5 \cdot 10^{12}$ particles per cm^2 of true surface area. The data obtained conform to the suggestion made in [6] that the nickel electrode in aqueous KOH solutions is covered by a layer of adsorbed water dipoles which prevent the adsorption of organic material.

The authors thank V. E. Kazarinov and A. G. Pshenichnikov for valuable remarks made in discussing the present work.

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Institute of Electrochemistry, Academy of Sciences of the USSR, Moscow. Translated from Élektrokhimiya, Vol. 14, No. 7, p. 1131, July, 1978. Original article submitted December 6, 1977.

0038-5387/78/1407-0983$07.50