Methanol electro-oxidation at platinum electrode: In situ recovery of CO poisoned platinum electrode

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Methanol oxidation at polycrystalline (poly-Pt) electrode in acid medium is retarded by the formation of carbon monoxide intermediate as a result of poisoning of the active sites upon the first potential scan and as a result of the dissociative adsorption of methanol. This retards the subsequent oxidation to carbon dioxide, which probably occurs at large anodic potential. In the present work the possible In situ recovery of the poisoned platinum electrodes using potentiodynamic and potentiostatic techniques are investigated. In potentiodynamic one, both short range recovery (SRR), i.e., in the potential range - 0.2 to 0.9 V and, long range recovery (LRR), i.e., in the range - 0.2 to 1.3 V are conducted. Recycling the potential according to the former scenario results in more poisoning of the electrode as reflected in the continuous decrease of the peak current of the methanol oxidation, while recycling the potential in the wide potential range (LRR) resulted in the complete recovery, even the peak current increases upon the continuous potential cycling. It is likely that the deactivation of the electrochemical response upon SRR is due to the accumulation of the CO intermediate, and the activation upon LRR is due to the sweeping of the formed CO as a result of the oxidation by the adsorbed hydroxide at large potential. In the potentiostatic one, the electrode is conditioned for various time period at either – 0.9 or – 1.3 V. Conditioning the potential at – 0.9 V activated the electrode, while at – 0.1.3 V recovered the activity.

Keywords: Methanol oxidation, platinum, poisoning, recovery.

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