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In-situ electrochemical surface-enhanced Raman spectroscopy study of formic acid electrooxidation at variable temperatures by high-frequency heating technology

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Abstract

The combination of in-situ electrochemical surface-enhanced Raman spectroscopy (EC-SERS) and high-frequency heating technology was used to investigate formic acid (HCOOH) electrooxidation at variable temperatures. Any preset temperature could be adjusted within 1 second on the surface of the working electrode (thermocouple microelectrode, TCME) by using the high-frequency heating technology. Cyclic voltammetry and EC-SERS were used to investigate the electrooxidation behavior of HCOOH on the surface of Au@Pt nanoparticles. Cyclic voltammetry showed that elevated temperatures improve the catalytic activity of Au@Pt/TCME toward HCOOH oxidation. The EC-SERS results showed that the intensity of the Pt-C band decreased with an increase in temperature, which indicates that a high temperature favors the oxidative desorption of CO from the Pt surface and improves the catalytic reaction. This work could be used to screen catalysts for HCOOH electrooxidation at high temperature, or for other investigations of EC-SERS at variable temperatures.

Keywords: Formic acid; Electrocatalysis; Surface-enhanced Raman spectroscopy; Au@Pt ; Temperature modulation