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Extraordinary electrocatalytic performance for formic acid oxidation by the synergistic effect of Pt and Au on carbon black

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Abstract

Improving catalyst performance and understanding reaction mechanism of formic acid electrooxidation (FAO), a typical anodic reaction in fuel cells, are of technological and scientific importance. Here, Pt-Au/C catalysts were designed and synthesized for catalyzing the FAO reaction. An ultrasound-assisted method was developed to enable the uniform and dense loading of Pt and Au on carbon black without any surfactant. The Pt-Au/C sample with a Pt/Au atomic ratio of 32:68 exhibits an FAO catalytic activity of $14.5 \text{ A}\cdot\text{mg}_{\text{Pt}}^{-1}$, which is 153 times higher than that of Pt/C. The extraordinary performance is attributed to the optimized synergistic effect of Pt and Au. Density functional theory calculations disclose that the neighboring Au decreases the reaction energy barriers of the direct pathway on Pt. This work demonstrates a promising FAO catalyst and an effective strategy to obtain supported catalysts.

Graphical abstract

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