Electrocatalysis via Freely Dispersed Au Nanoparticles at Ultramicroelectrode in Alkaline Media

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Gold nanoparticles (Au NPs) are widely known for their high surface reactivity and electrocatalytic potential, making them useful in various applications such as sensing, energy storage, and catalysis. This study investigates the electrocatalytic behavior of freely dispersed Au NPs in alkaline media using chronoamperometry and cyclic voltammetry at a carbon fiber microelectrode.

Unlike traditional systems where nanoparticles are immobilised on electrodes, this work demonstrates that non-immobilised Au NPs can also significantly enhance catalytic processes and currents, particularly above 0.7 V vs Ag/AgCl (Figure 1). We observe that the catalytic enhancement is strongly dependent on the electrolyte composition and scan rate.

This work introduces a non-conventional catalytic mode where transient interactions such as brief adsorption, collisions, or near-surface electron transfer might be facilitating charge transfer. This behaviour resembles concepts from impact electrochemistry, where individual nanoparticles catalyse reactions during stochastic collisions with an electrode. The findings offer a perspective on nanoparticle-mediated catalysis and suggest promising routes for developing dynamic, solution-based electrochemical systems.

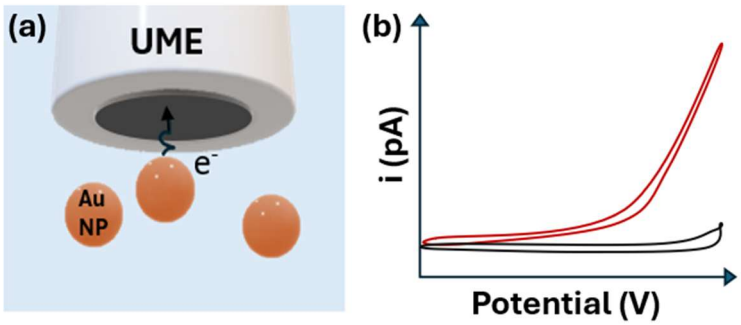

Figure 1. (a) Interaction and assembling of nanoparticle with microelectrode surface, (b) corresponding cyclic voltammogram showing catalytic activity in the presence of solution-dispersed Au nanoparticles.

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References

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