Surface engineering of Pd/Pt-based nanocatalysts for efficient electrochemical catalysis

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Abstract.

Noble metal-based nanomaterials, especially the Pd/Pt-based nanomaterials, are regarded as the most efficient electrocatalysts toward fuel cell applications. Precise control over nanocatalysts at the surface, where the redox reactions take place, represents an attractive direction to improve the catalytic performance. Therefore, we are focusing on the precise surface engineering of Pd/Pt nanocrystals to regulate their intrinsic activity and in turn to promote the catalytic performance.

We design a facile strategy for controlling the surface morphology evolution of Au@Pd core–shell nanorods by adjusting the solution supersaturation.[1] The Pd shell of the Au@Pd bimetallic nanorods can be modulated from a (111) facet-exposed island to a (100) facet-exposed conformal shell. The conformal shell structure exhibited enhanced catalytic performance toward the ethanol oxidation reaction, while the core-island structure possessed better catalytic stability.

We also report a new class of composition-controllable zigzag-like platinum-zinc (Pt-Zn) alloy nanowires (NWs) with high-density high-index facets.[2] Particularly, the highly rough surface endows the composition-optimal $Pt_{94}Zn_6$ NWs with a mass activity of 7.2 and 6.2 times higher than that of commercial Pt black catalysts toward methanol/ethanol oxidation, respectively.

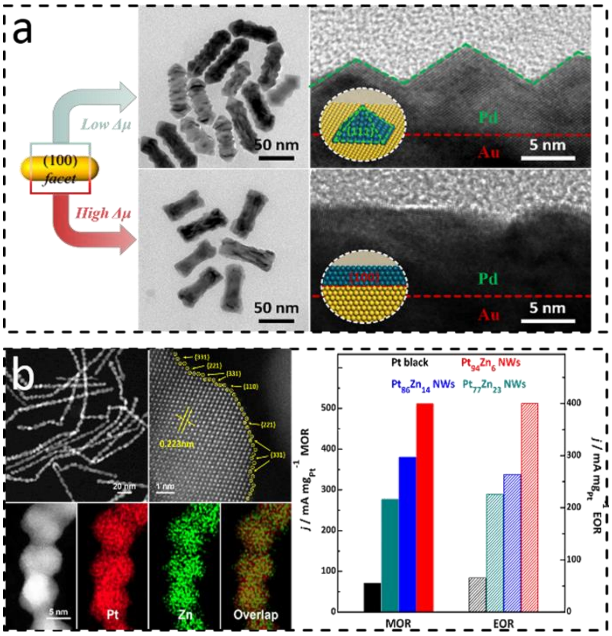

Figure 1. (a) supersaturation-controlled surface morphology evolution of Au@Pd core–shell nanorods; (b) zigzag-like Pt-Zn alloy NWs with high-density high-index facets.

References

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[2] Yanchao Xu, Xiaoqiang Cui*, et al. Highly active zigzag-like Pt-Zn alloy nanowires with high-index facets for alcohol electrooxidation. *Nano Res.*, **2019**, *12*, 1173–1179.