

Conformal Noble Metal High-Entropy Alloy Nanofilms by Atomic Layer Deposition for Enhanced Hydrogen Evolution Reaction/Oxygen Evolution Reaction Electrocatalysis Applications

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Abstract : High-entropy alloy (HEA) coatings comprise multiple (five or more) principal elements that give superior mechanical, electrical, and thermal properties. However, the current synthesis methods of HEA coating still face huge challenges in facile and controllable preparation, as well as conformal integration, which seriously restricts their potential applications. Herein, we report a controllable synthesis of conformal quinary HEA coating consisting of noble metals (Rh, Ru, Ir, Pt, and Pd) by using the atomic layer deposition (ALD) with a post-annealing approach. This approach realizes low temperature (below 200 °C), precise control (nanoscale), and conformal synthesis (over complex substrates) of HEA coating. Furthermore, the resulting quinary HEA coating shows promising potential as a platform for catalysis, exhibiting substantially enhanced electrocatalytic hydrogen evolution reaction (HER) and oxygen evolution reaction (OER) performances as compared to other noble metal-based structures such as single metal coating or multi-layered metal composites.

Keywords : high-entropy alloy, thin-film, catalysis, water splitting, atomic layer deposition

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