3D ordered nanoporous nickel electrode for highly efficient water oxidation reaction

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Hydrogen generation by water electrolysis has been comprehensively studied for several decades, although it still faces many difficulties in commercialization due to low efficiency. To overcome the limitation of OER, former researches have been studied with various materials which are cheaper and perform better than the novel metal-based electrocatalysts. Among them, nickel is considered as the best catalyst candidate due to hydroxide state transformation between Ni(OH)2 and NiOOH during the surface reaction.
Herein, we synthesized three-dimensional ordered nanoporous mesh-like (3D-NM) nickel electrode by the photolithography method, which outperforms conventional porous nickel electrode. Successfully synthesized ordered nanoporous mesh-like structure provides highly extensive surface area within thickness of only 5 μm. Through the unique nanoporous structure of nickel electrode, outstanding stability for 50 hours was achieved. To further improve the OER activity of as-prepared 3D-NM nickel electrode, the decoration of nickel and iron was conducted. The final 3D-NM NiFe electrode showed 261 mV of overpotential at 10 mA cm-2 with 43.8 mV dec-1 of Tafel slope.