Ni-based Microflowers for Water Splitting

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The quest for sustainable and efficient electrocatalysts for water splitting has driven extensive research toward the development of novel and more performing Ni-based nanostructures. In this study, we present a comprehensive investigation into the oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) applications of Ni-based microflowers, desert rose-like porous structures composed of interconnected nanosheets, prepared by a facile, low-cost, and scalable chemical bath deposition. The optimization of alkaline OER was performed by exploring different strategies, including the identification of the ideal crystal structure between $Ni(OH)_2$ and NiO and the optimum transition metal dopant, achieving a lowest overpotential of 297 mV at 10 mA cm^{-2} and a high intrinsic activity, as indicated by a high turnover frequency of 4.6 s^{-1} at 300 mV overpotential, for Fe-doped NiO microflowers. [1,2] Regarding alkaline HER, NiO microflowers with ultralow amounts of chemically synthesized Pt nanoparticles demonstrated a remarkably low overpotential of 66 mV at a current density of 10 mA cm^{-2} and a high turnover frequency of 2.07 s^{-1} at 50 mV overpotential.[3] The superior number of active sites provided by the porous nature of the Ni-based microflowers and the enhanced electrocatalytic activity in the presence of transition metal dopants and co-catalysts open avenues for developing cost-effective and highly efficient electrocatalysts for water splitting technologies.

References

[1] Bruno, L., Scuderi, M., Priolo, F., Mirabella, S. Sustainable Energy & Fuels 2022, 6(19), 4498-4505.
[2] Battiato, S., Pellegrino, A. L., Pollicino, A., Terrasi, A., Mirabella, S. International Journal of Hydrogen Energy 2023, 48(48), 18291-18300.
[3] Bruno, L., Battiato, S., Scuderi, M., Priolo, F., Terrasi, A., Mirabella, S. International Journal of Hydrogen Energy 2022, 47(80), 33988-33998.

Figures

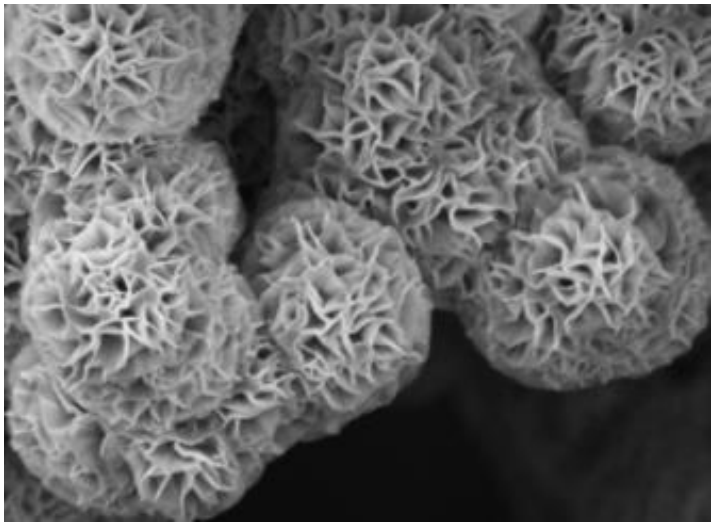

Figure 1: NiO microflowers produced by low-cost method and applied as efficient water splitting catalysts.