A Cooler Way to Make Powerful Metal Catalysts

Scientific Achievement

A CINT User Team developed a route to iron and iron–nickel nitride catalysts using a low-temperature, gas-free method that works entirely in solution. The process forms high-purity particles below 300 °C, eliminating the need for ammonia or hydrogen and achieving catalytic performance comparable to expensive noble-metal oxide.

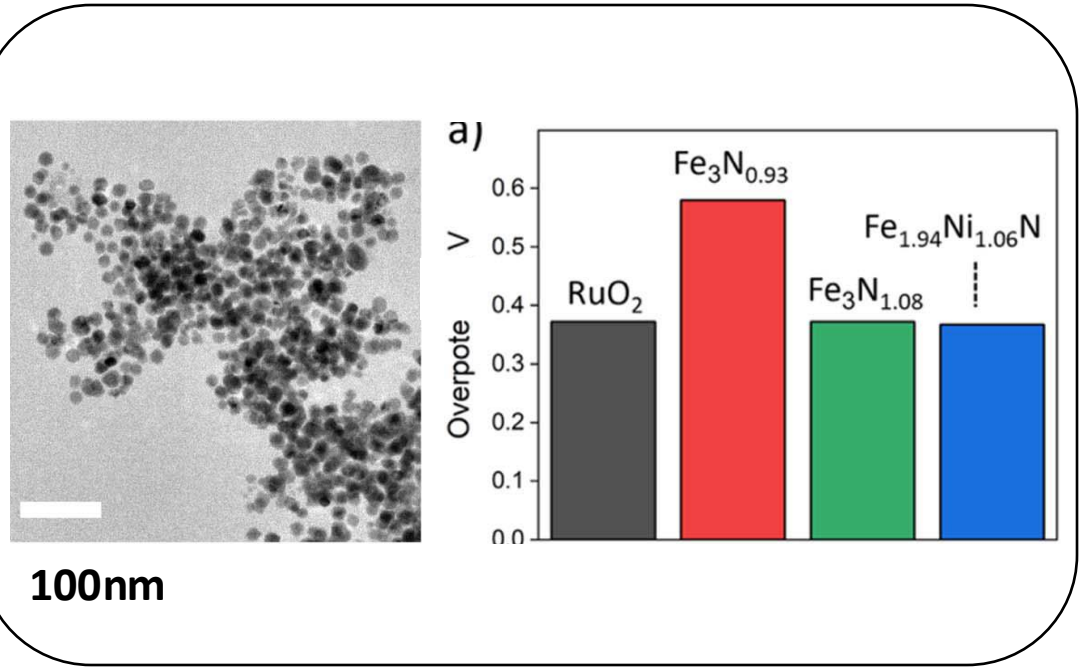

Figure: TEM image of $Fe_3N_{1.08}$ NPs and a comparison of overpotentials for obtained metal nitrides and RuO_2

Significance and Impact

A low-temperature, gas-free solution route yields phase-pure Fe_3N_x and Fe–Ni nitrides with tunable nitrogen content and OER performance comparable to RuO_2, addressing long-standing safety and scalability hurdles in nitride synthesis.

Research Details

- Synthesized Fe and Fe–Ni nitride nanoparticles (NPs) from metal clusters and urea or diethylenetriamine.
- Tuned nitrogen content and phase by adjusting temperature and precursor ratios.
- Demonstrated that both nitrogen-rich $Fe_3N_{1.08}$ and $Fe_{1.94}Ni_{1.06}N$ exhibit activity comparable to RuO_2 under alkaline conditions.

DeLaney, C. R.; Diaz-Abad, S.; O'Leary, S.; Gonzàlez-Rosell, A.; Martinez, U.; Maurya, S.; Ivanov, S. A.; Watt, J. Low-Temperature Access to Active Iron and Iron/Nickel Nitrides as Potential Electrocatalysts for the Oxygen Evolution Reaction. *Journal of Materials Chemistry A*. 2025.

Work was performed, in part, at the Center for Integrated Nanotechnologies.