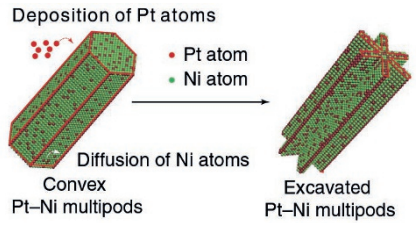
Nature Reviews Chemistry | Published online 29 Mar 2018; doi:10.1038/s41570-018-0144

IN BRIEF

HETEROGENEOUS CATALYSIS

Metastable multipods



Alloymorphs of noble metal nanocrystals are hard to come by. For example, samples of platinum–nickel alloys — among the best materials we have for reducing dioxygen or protons — invariably assume a face-centred cubic structure. But what if, en route to this thermodynamically stable phase, the alloys exist as metastable structures with distinct properties? If isolable, such a metastable phase may be an inherently better electrocatalyst, a prospect that motived a team led by Yaqi Jiang, Gang Fu and Zhaoxiong Xie to explore a mild route to platinum–nickel alloys by reduction of molecular platinum and nickel precursor mixtures. Their findings in *Nature Communications* show that although prolonged heating of these precursors affords face-centred cubic crystals, clean generation of a hexagonal close-packed structure occurs after short reaction times. Electron microscopy and X-ray diffraction indicate that the new crystals take the form of excavated hexagonal prisms — excavated 'multipods' that feature 2.5 nm-thick sheets composed of platinum (11.5%) atoms dispersed in nickel (88.5%).

The new material is interesting in that the excavated 'multipods' comprise six sheets radiating outwards from a central axis. In turn, several 'multipods' grow out from a central point, such that we have star-shaped particles with high surface areas and exposed platinum sites. These features are reflected in the new excavated structure exhibiting, of all known platinum-based catalysts, the highest current density for proton reduction per mass of platinum at −70 mV versus the reversible hydrogen electrode. In addition to being fast, the catalyst operates at a low overpotential (65 mV at 10 $mAcm^{-1}$), such that we have an energy-efficient heterogeneous catalyst for hydrogen production. By carefully monitoring other mild alloy-forming reactions, we may arrive at a suite of new alloymorphs with distinct catalytic, optical and magnetic behaviours.

David Schilter

ORIGINAL ARTICLE Cao, Z. et al. Platinum–nickel alloy excavated nano-multipods with hexagonal close-packed structure and superior activity towards hydrogen evolution reaction. *Nat. Commun.* **8**, 15131 (2017)