Rare Pt nanostructures for efficient energy harvesting

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Abstract:
Pt based nanostructures are the widely sought after metal-based nanomaterials for various catalytic applications including renewable energy harvesting, which, due to growing energy demand, is fast emerging as a key research area. Despite extensive investigations, certain Pt nanocrystals with excellent potential performance have remained elusive, giving rise to important research challenges. This talk will illustrate our recent successes in realizing such nanostructures that leads to enhanced energy harvesting.

Earlier we established that by generating a secondary amine in-situ during their synthesis, sub 10 nm Pt nanotetrahedra (NTds with (111) surfaces that are thermodynamically unfavourable) exhibiting one of the highest electrochemical efficiencies towards fuel reduction can be obtained. Subsequently, we demonstrated a mechanochemical unzipping process of a nanotube structure to yield robust free-standing ~26 nm thick Pt nanosheets, a rare morphology for metals. Therein, shear forces (~2 N) and shear stress (~24000 Pa) generated by stirring in a solution was utilized to mechanochemically zip open an 1D nanostructure to form a nanosheet. Nanocrystals are crystallographically connected to each-other within the nanosheets and therefore can be used for electrochemical applications without using conducting supports. This alleviates the problems associated with catalyst masking by the catalyst-support and leads to high mass-activity in fuel cell reactions. Besides, a 'support-less' strategy involving Pt nanowire membrane recently developed by us will be discussed.

References and Notes:

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