Nitrogen-doped Hollow Porous Carbon Sphere Encapsulated $PtNi_xRh_y$-alloy Nanoparticles as Methanol Oxidation Electrocatalysts in Alkaline Electrolyte

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To increase the catalytic activity of Pt for the methanol oxidation reaction (MOR), alloying with other metals and/or shape control of the nanoparticles (NP) has been proven as a successful method. However, many of the reported catalyst NP are often of rather large particle size and inhomogeneous size distribution. Another problem is the poor durability since the NP, which are deposited onto highly porous carbon particles, easily detach and agglomerate. We have recently shown that very small (2.0 ± 0.4 nm) PtNi-alloy NP, synthesized under assistance of 2,2'-Dipyridylamine (dpa) and encapsulated into hollow porous carbon spheres (HPCS), show a remarkable activity and durability for oxygen oxidation reaction.[1] Based on our result we have now synthesized $PtNi_x$ NP under assistance of dpa, that are encapsulated in Nitrogen-doped HPCS (NHPCS), and tested for MOR activity in alkaline solution. By optimizing the PtNi ratio and optionally adding a third metal, Rh, we aim to further increase the catalytic activity for MOR.

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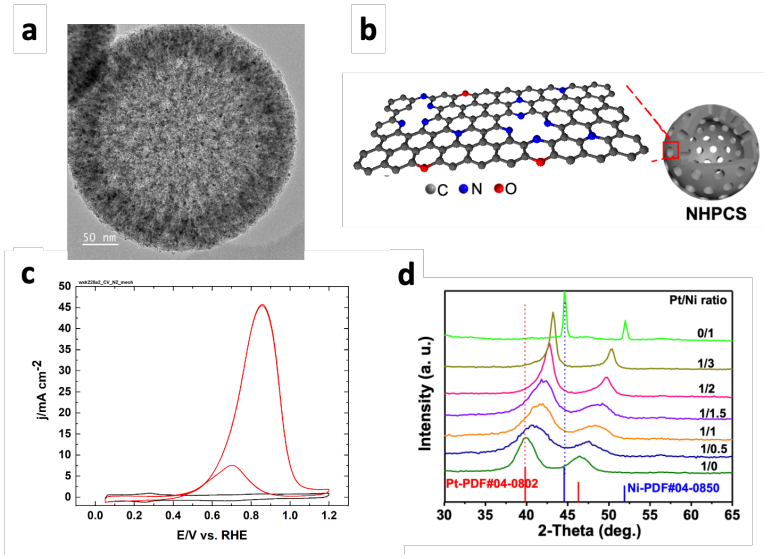

Figure 1. (a) STEM of PtNi(dpa)/N-HPCS (b) NHPCS structure (c) cyclic voltammograms of PtNi(dpa)/NHPCS in 1 M KOH (black) and in 1 M KOH + 1 M MeOH (red) (d) XRD pattern of $PtNi_x$(dpa)/NHPCS