Carbon nanotube-based novel non-precious metal electrode catalyst with high performance

カーボンナノチューブを素材とした貴金属を使わない新しい高性能電池触媒デザイン

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The development of Pt-free metal electrocatalysts for fuel cells, water splitting and batteries with high performance, durability, and scalability is a strong social demand for the next-generation eco-friendly energy society[1]. Recently, we have already reported that i) nanocarbons/iron phthalocyanine (II) hybrids with well-defined nanostructures show excellent efficiency for oxygen reduction reaction (ORR)[2,3], ii) decorating unoxidized-carbon nanotubes with homogeneous Ni-Co-spinel nanocrystals that show superior performance for oxygen evolution (OER) and ORR[4] and iii) Fe^{III}-doped nickel sulfides/carbon nanotube hybrid catalyst for alkaline electrolyte membrane water electrolyzer and enhanced Zn-air battery performance[5].

Here we report the design and synthesis of a less-expensive metal-coordinated poly(thiourea-formaldehyde) polymer/nanocarbon (Vulcan, porous carbon, 2-differernt multi-walled carbon nanotubes, or single-walled carbon nanotubes) hybrid catalysts. The catalysts were found to show high oxygen electrode performance with ORR: $E_{1/2}$: 0.81V *vs*. RHE, and OER: 1.57 V *vs*. RHE at 10 mA/cm^2. The catalyst also showed an efficient and durable cathode for a rechargeable Zn-air battery (charge-discharge overpotential gap of 0.45 V). Such a study is of importance in the development of advanced energy materials in batteries and molecular catalyst.

References

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