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Recent Advances in the Organic Solution Phase Synthesis of Metal Nanoparticles and Their Electrocatalysis for Energy Conversion Reactions

Qing Li[†] and Shouheng Sun^{*}

Department of Chemistry, Brown University, Providence, Rhode Island 02912, USA

^{*}E-mail: ssun@brown.edu

[†]Current address: School of Materials Science and Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

Abstract: Metal nanoparticles (MNPs) are essential catalyst components in electrochemical energy conversion and storage devices, including fuel cells, Li-air batteries and water-splitting systems. Syntheses of monodisperse MNPs with controlled sizes, shapes and structures is key to fully harvesting their catalytic capabilities. This review first outlines the fundamentals of the synthesis of monodisperse MNPs by organic solution phase reactions. It then summarizes common strategies applied to tailor MNP size, shape and structure. The review further highlights recent advances of using MNPs as efficient catalysts to catalyze some representative reactions that related to energy conversions, including oxygen reduction reaction, hydrogen evolution reaction, CO₂ reduction reaction, methanol/formic acid oxidation reaction, and oxygen evolution reaction.

Keywords: Metal nanoparticles, solution phase synthesis, electrocatalysis, energy conversions.

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