Pd Nanoparticles Anchored on N-rich Graphdiyne Surface for Enhanced Catalysis for Alkaline Electrolyte Oxygen Reduction

Yanrong Li^{1†}, Yao Liu^{2†}, Zhongbin Li^{2*}, Jiaqiang Li³, Chaozhong Guo^{2,*}, Jin Zhang^{1,2}, Jinbiao Wang^{2,*}

¹ College of Materials Sciences and Engineering, Chongqing University of Technology, Chongqing 400054, P. R. China.

² Research Institute for New Materials Technology, School of Chemistry and Chemical Engineering, Engineering Research Center of New Energy Storage Devices and Applications, Chongqing University of Arts and Sciences, Chongqing 402160, P. R. China.

³ School of Chemistry and Chemical Engineering, Chongqing University, Chongqing 401331, P. R. China.

*E-mail: guochaozhong1987@163.com

[†]These authors equally contributed to this work, and they are the co-first author.

doi: 10.20964/2018.12.63

Received: 28 August 2018 / Accepted: 30 September 2018 / Published: 5 November 2018

Graphdiyne (GDY) as a novel allotrope has been theoretically predicted to be the most stable non-natural carbon allotropes. However, GDY has not been systematically investigated as a new carbon support to ORR catalysts. Thus, here we report a new strategy for the synthesis of Pd nanoparticles anchored on nitrogen-doped graphdiyne (CN_x-Pd@GDY) electrocatalyst for oxygen reduction reaction (ORR) *via* a facile pyrolysis method. The results show that the prepared CN_x-Pd@GDY catalyst has exhibited excellent ORR catalysis performance with a four-electron transfer pathway in 0.1 mol l⁻¹ KOH electrolyte compared to other commercial carbon supports such as carbon black and carbon nanotubes. Electrochemical research results show that the as-formed CN_x-Pd@GDY exhibits excellent electrocatalytic ORR activity with an onset potential of 0.96 V *vs.* RHE and a high long-term stability in the alkaline condition. The interaction between Pd nanocrystals and the encapsulating PANI shells was found in the catalyst, which markedly contributes to the improvement in ORR catalytic activity and stability of the catalyst. Such catalytic characteristics have reasonably indicated a great potential as a novel catalyst for ORR instead of the commercial Pt-based catalyst.

Keywords: N-rich Graphdiyne, Electrocatalyst, Oxygen reduction reaction

[FULL TEXT](#)

© 2018 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).