Engineering Defect-Rich Ni Layered Double Hydroxide Electrocatalyst on N-CNTs for Rechargeable Zn-Air Batteries

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Highly active, durable, and cost-effective electrocatalysts for water oxidation to evolve oxygen gas hold a key to a range of renewable energy solutions, including water-splitting and rechargeable metal−air batteries. Currently, we focus on the preparation of doped graphene/carbon nanotubes, which can be directly used or combined with other materials as electrocatalysts towards oxygen evolution reaction (OER) and oxygen reduction reaction (ORR) for metal-air batteries [1-5]. Herein, we report an active and stable OER catalyst of defect-rich $Ni(OH)_2$ nanosheets on interwoven N-CNTs by one-step CVD method combined with electrodeposition and plasma treatment (Figure 1). The as-prepared catalyst exhibits greatly enhanced catalysis ability towards OER with low overpotential (about 254 mV at a current density of 10 mA cm^{-2}) and long-term durability (over 100 h at 10 mA cm^{-2}). Afterwards, the sample will be explored for the rechargeable Zn-air batteries. This study lays a new route for smartly designing advanced electrode materials for electrochemical catalysis.

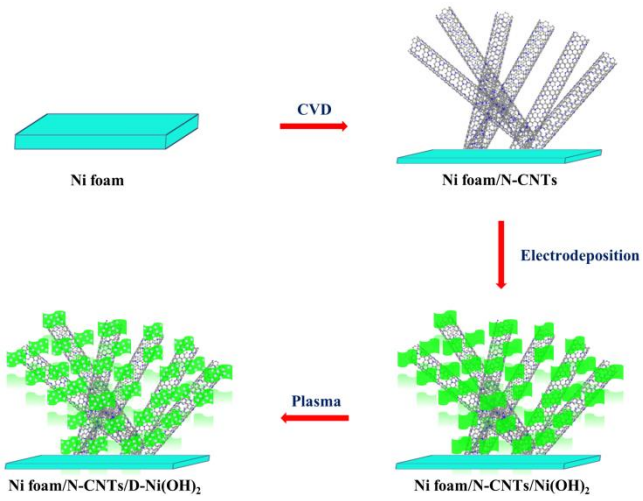

Figure 1 Schematic illustration of the synthesis process of the defect-rich $Ni(OH)_2$ nanosheets on three-dimensional Ni foam/N-CNTs substrate.

References:

[1] D. Geng, Y. Chen, Y. Chen, Y. Li, R. Li, X. Sun, S. Ye, S. Knights, Energy Environ. Sci. 4 (2011) 760-764.
[2] D. Geng, N. Ding, T. S. A. Hor, S. W. Chien, Z. Liu, D. Wuu, X. Sun, Y. Zong, Adv. Energy Mater. 6 (2016) 1502164.
[3] J. Wu, P. Guo, R. Mi, X. Liu, H. Zhang, J. Mei, H. Liu, W. M. Lau, L. M. Liu, J. Mater. Chem. A. 3 (2015) 15331-15338.
[4] D. Geng, N. N. Ding, T. S. Andy Hor, S. W. Chien, Z. Liu, Y. Zong, RSC Adv. 5 (2015) 7280-7284.
[5] J. Wu, J. Subramaniam, Y. Liu, D. Geng, X. Meng, J. Alloys Compd. 731 (2018) 766-773.