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Hierarchical Dopamine Decorated Carbon Nanotubes towards Highly Efficient Oxygen Reduction Reaction

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Oxygen reduction reaction (ORR) catalysts are the heart of eco-friendly energy resources particularly low temperature fuel cells. Although valuable efforts have been devoted to synthesize high performance catalysts for ORR, considerable challenges are extremely desirable in the development of energy technologies. Herein, we report a simple self-polymerization method to build a thin film of dopamine along the tubular nanostructures of multi-walled carbon nanotubes (CNT) in a weak alkaline solution. The dopamine@CNT hybrid (denoted as DP@CNT) reveals an enhanced electrocatalytic activity towards ORR with highly positive onset potential and cathodic current as a result of their outstanding features of longitudinal mesoporous structure, high surface area, and ornamentation of DP layers, which enable fast electron transport and fully exposed electroactive sites. Impressively, the as-obtained hybrid afford remarkable electrochemical durability for prolonged test time of 60,000 s compared to benchmark Pt/C (20 wt%) catalyst. Interestingly, the synergetic effect of nanostructured DP and CNT can significantly boost the electronic configuration and exposure level of active species for ORR. Therefore, the existing carbon-based porous electrocatalyst may find numerous translational applications as attractive alternative to noble metals in polymer electrolyte membrane fuel cells.