Structural Requirements of Carbon Materials for Active and Durable Oxygen Evolution Electrocatalysis

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Carbon-based materials have shown promises as cost-effective catalysts. It is essential to understand the structural requirements of carbon materials for advanced carbon-based OER catalysts. In this work, we investigated the OER activity and stability using four commercial carbons with different degrees of graphitization and BET surface areas (acetylene black; AB, carbon nanotube; CNT, Ketjen black; KB, and Vulcan XC-72). Electrochemical analysis combined with physicochemical characterizations revealed that the initial OER activity of carbon materials appeared mainly dependent on their surface areas. During the OER durability test, the OER activity gradually decreased with the potential cycles for amorphous carbon. In contrast, the OER activity of the graphitic carbons increased during the successive potential cycles. In addition, the degree of activation or deactivation of carbon materials was proportional to their BET surface areas. We attribute the activation of the graphitic carbon to the oxidative-potential-deriven in situ doping of oxygen on the smooth graphitic carbon surface, while amorphous carbon appears easily corroded away under the high OER potential.