Synthesis of Molybdenum Carbide/Nitrogen-Doped Carbon Composite Derived from Kraft Lignin for Hydrogen Evolution Reaction in Alkaline Media

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To deal with continuous energy consumption and consequent air pollution, hydrogen energy is drawing attention due to its high energy density and CO_2-neutral. Water electrolysis is regarded as a clean H_2 production method, but its wide-spread application is limited owing to scarcity and high cost of Pt-based catalysts which are most commonly used in hydrogen evolution reaction (HER). Thus, it is crucial to design efficient HER electrocatalysts based on non-noble metals. Kraft lignin, the second abundant biopolymer and a by-product of chemical pulping industry, is a cheap material possessing a 3D network structure with high carbon content. However, most of the Kraft lignin are not utilized and are incinerated up to now. For the valorization of industrial lignin, we have developed a new fabrication method for molybdenum carbide using lignin as carbon sources for carbide and support formation. During the synthetic procedure, toxic gases were not used and additional N-doping was achieved by introducing urea. The resultant molybdenum carbide/N-doped carbon composite showed high activity and stability with an overpotential value of 131 mV at 10 $mAcm^{-2}$ in 1M KOH.