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Investigation of nitrogen-doped graphene as catalyst and catalyst support for oxygen reduction in both acidic and alkaline solutions[1]
JINCHENG BAI, 1 College of Materials Science and Engineering, Qingdao University of Science and Technology, China 2 Department of Physics, Astronomy, LIFENG DONG, Department of Physics, Astronomy, and Materials Science, Missouri State University, Springfield, MO 65897 — Fuel cells are promising energy devices with low pollutant emission and high energy conversion efficiency. However, the performance of fuel cells depends on oxygen reduction reaction. In order to solve the slow kinetics of oxygen reduction reaction, carbon materials have been utilized as catalyst supports for fuel cells. In this study, graphene and nitrogen-doped graphene were synthesized through a solvothermal method and investigated as catalysts for oxygen reduction reactions. Electrochemical measurements demonstrated that N-doped graphene possessed higher electrocatalytic activity than graphene in both acidic and alkaline solutions. N-doped graphene can directly act as a catalyst to facilitate four-electron oxygen reductions in alkaline solution but two-electron reductions in acidic solution. On the other hand, when employed as catalyst supports for platinum and Pt-ruthenium nanoparticles, N-doped graphene can contribute to four-electron oxygen reductions in acidic solution, yet in alkaline solution the kinetics of reduction reaction is slow. So N-doped graphene can work as an efficient catalyst for oxygen reductions to substitute the precious Pt catalysts in alkaline solution and and Pt-Ru catalysts in acidic solution.

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