

Electrochemical synthesis of ammonia (NH₃) under ambient temperature and pressure

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The reduction of N₂ to NH₃ is one of the most influential achievement in the field of heterogeneous catalysis. Ammonia is primarily used for the production of fertilizers and enabled the population growth in the 20th century. Due to the difficulties in activating stable N₂ molecule, ammonia is still produced in this century-old Haber-Bosch process in the large centralized plants. The electrochemical NH₃ production offers an attractive alternative where the electricity could be used to drive the reaction, enabling decentralized production. However, the field of electrochemical ammonia production is lacking a standardized procedure. Ammonia is often present in the environment and can easily contaminate the experimental data. Coupled with low N₂ reduction activity, it is difficult to determine the real source of measured ammonia. Here, rigorous experimental protocol will be presented to address the most common problems in benchmarking the electrochemical ammonia production. Quantitative isotopic measurement is indispensable for benchmarking the electrochemical NH₃ synthesis. A successful electrochemical production of NH₃ using Li-mediated process will be presented.