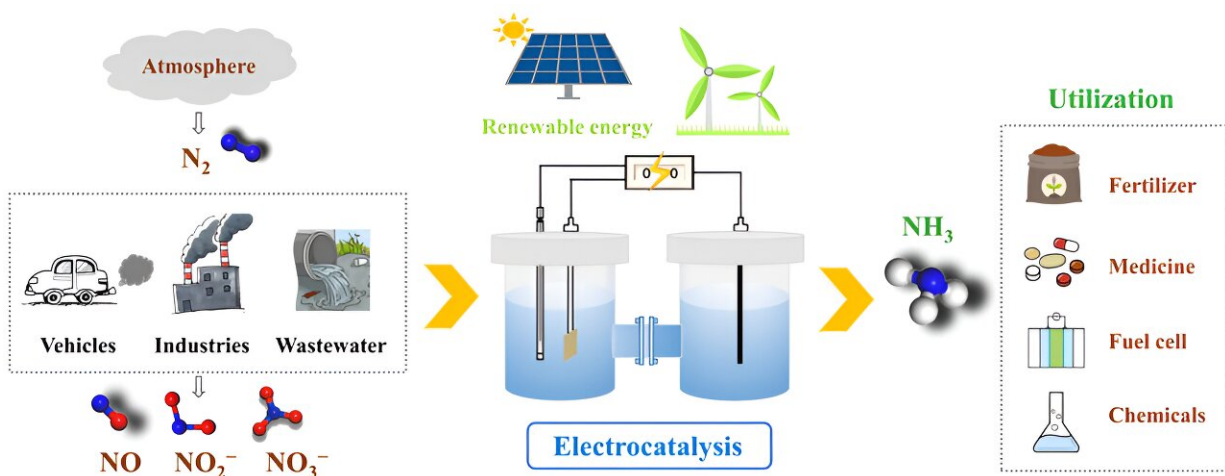


# Recent advances in electrocatalytic ammonia synthesis

August 21 2023



Artificial Electrocatalytic Ammonia Synthesis (Which Can Couple With Clean Renewable Electricity) Is Recently Becoming A Research Hotspot. Researchers Review Recent Advances In Electrocatalytic Ammonia Synthesis Involving Electrocatalytic Nitrogen Reduction Reaction, Nitric Oxide Reduction Reaction, And Nitrate/Nitrite Reduction Reaction. The Challenges And Future Perspectives Are Also Proposed In The Concluding Remarks. Credit: *Chinese Journal of Catalysis* (2023). DOI: 10.1016/S1872-2067(23)64464-X

NH<sub>3</sub> is the second largest chemical produced in the world and nearly 80% of produced NH<sub>3</sub> is employed in fertilizer synthesis. Meanwhile, NH<sub>3</sub> is an indispensable raw material for manufacturing nitric acid, which can be further employed in chemical production.

Moreover,  $\text{NH}_3$  possesses high hydrogen capacity, making it a potential carbon-free fuel. As one of the greatest inventions, the Haber-Bosch process enables the large-scale production of value-added  $\text{NH}_3$ ; however, it is against the principle of sustainable development theory due to the high operational costs and negative environmental impacts of the Haber-Bosch process.

Hence, it is imperative to explore green and sustainable approaches to produce  $\text{NH}_3$  and simultaneously realize global environmental sustainability.

Artificial electrocatalytic  $\text{NH}_3$  synthesis (which can couple with clean renewable electricity) is recently becoming a research hotspot, where the majority of researchers use  $\text{N}_2$  gas as the N source. Although electrocatalytic  $\text{N}_2$  reduction reaction (NRR) provides an eco-friendly and sustainable route for ambient  $\text{NH}_3$  production, the conversion efficiency of  $\text{N}_2$  reduction to  $\text{NH}_3$  is unsatisfactory because of the high thermodynamic stability of the  $\text{N}_2$  molecule.

Fortunately, the more active N sources (i.e.,  $\text{NO}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ) have been deemed as attractive precursors to achieve effective  $\text{NH}_3$  production, and meanwhile, the development of electrocatalytic  $\text{NO}$  reduction reaction (NORR) and  $\text{NO}_3^-/\text{NO}_2^-$  ( $\text{NO}_x^-$ ) [reduction reaction](#) (NtrRR) is also expected to control and mitigate the related environmental pollution.

Although many promising studies have been done in the field of artificial electrosynthesis of  $\text{NH}_3$ , the design and development of active electrocatalysts with high selectivity and stability to achieve efficient  $\text{NH}_3$  production remain certain challenges.

Recently, a research team led by Prof. Xuping Sun from University of Electronic Science and Technology of China introduced three electrochemical  $\text{NH}_3$  synthesis routes (NRR, NORR, and NtrRR) then

summarized recent advances in electrocatalyst development for ambient  $\text{NH}_3$  synthesis, mainly involving catalytic mechanisms, theoretical advances, and electrochemical performance.

The challenges and future perspectives are also proposed in the concluding remarks, aiming to provide experience and inspire more critical insights for the electrocatalytic  $\text{NH}_3$  [synthesis](#) reactions. The results were published in the *Chinese Journal of Catalysis*.

**More information:** Ling Ouyang et al, Recent advances in electrocatalytic ammonia synthesis, *Chinese Journal of Catalysis* (2023). [DOI: 10.1016/S1872-2067\(23\)64464-X](https://doi.org/10.1016/S1872-2067(23)64464-X)

Provided by Chinese Academy of Sciences

Citation: Recent advances in electrocatalytic ammonia synthesis (2023, August 21) retrieved 3 May 2024 from <https://phys.org/news/2023-08-advances-electrocatalytic-ammonia-synthesis.html>

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