

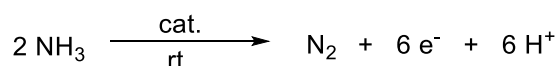
## Development of Cobalt-Catalyzed Ammonia Oxidation under Ambient Reaction Conditions

(Graduate School of Engineering, the University of Tokyo) ○Aiwei Zhao, Hiroki Toda, Shogo Kuriyama, Yoshiaki Nishibayashi

**Keywords:** Cobalt complexes; Ammonia oxidation; Electrocatalysis; Salen ligand

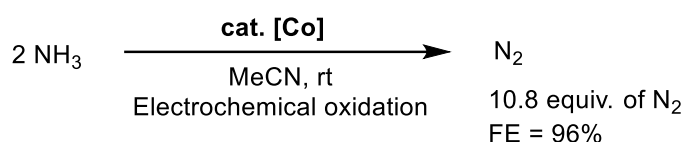
To realize the direct use of ammonia as an energy carrier, the development of catalytic ammonia oxidation reaction into dinitrogen is necessary. Homogeneous molecular catalysts for ammonia oxidation, especially with transition-metal complexes, are one of the attractive targets from viewpoints of fundamental mechanistic studies and the development of highly active and robust electrocatalysts (Scheme 1).<sup>1</sup>

### Scheme 1

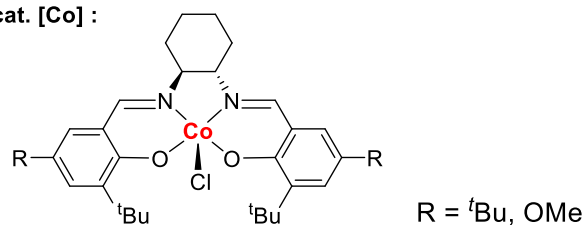


Previously, our group reported ammonia oxidation using manganese-salen complexes as catalysts.<sup>2</sup> As an extensive study, we have investigated the catalytic activity of a series of cobalt-complexes bearing various salen ligands toward ammonia oxidation under ambient reaction conditions. As a result, we have found that these cobalt salen complexes worked as efficient catalysts for ammonia oxidation under electrochemical conditions with lower overpotential ( $\eta = 1.26 \text{ V}$ ) than the manganese complexes ( $\eta = 1.6 \text{ V}$ ) according to the CV measurements. Bulk electrolysis of ammonia solution containing the cobalt complexes as catalysts provided 10.8 equiv. of  $\text{N}_2$  based on the cobalt atom with high faradaic efficiency (FE) of 96% (Scheme 2).

### Scheme 2



cat. [Co] :



1) Dunn, P. L.; Cook, B. J.; Johnson, S. I.; Appel, A. M.; Bullock, R. M. *J. Am. Chem. Soc.* **2020**, *142*, 17845. 2) Toda, H.; Kuroki, K.; Kanega, R.; Kuriyama, S.; Nakajima, K.; Himeda, Y.; Sakata, K.; Nishibayashi Y. *ChemPlusChem.* **2021**, *86*, 1511.