
Electrocatalytic Oxidation of Ammonia on Pt-Ru Catalysts: Activity and Selectivity Insights

Geraldo Novaes Tessaro¹, Joelma Perez^{1*}

¹ University of São Paulo (USP), São Carlos Institute of Chemistry (IQSC)

**e-mail: jperez@iqsc.usp.br*

Ammonia is a carbon-free molecule, containing 17.6 wt% hydrogen, with a higher energy density than liquid hydrogen, and greater economic feasibility for long-distance transportation [1]. Ammonia can serve as a hydrogen carrier and be directly used at the anode of fuel cells for power generation [2,3]. In this study, the ammonia oxidation reaction (AOR) was investigated on Pt, Ru and PtRu nanocatalysts supported on high surface area carbon, through voltammetric and chronoamperometric measurements, coupled with *in-situ* detection of volatile species via mass spectrometry and analysis of solution-phase species by ion chromatography. The electrochemical results showed that the PtRu electrocatalyst shifted the onset potential of AOR by 100 mV compared to Pt. The detection of volatile species on PtRu confirmed the earlier onset of N₂, the main product, and revealed enhanced formation of N₂O and HN₃. Additionally, the quantification of solution-phase products showed increased formation of NO₂⁻ and NO₃⁻ at higher potentials, along with the unprecedented detection and quantification of N₃⁻, confirming its participation in the AOR mechanism. Overall, the incorporation of Ru into Pt modified the AOR pathway favoring N₂ production at lower potentials, which is relevant for ammonia fuel cell applications.

Acknowledgments:

CAPES, CNPq, and FAPESP for the financial support.

References:

- [1] EL-ADAWY, M et al. Energy & Fuels, 38, p. 22686-22718 (2024)
- [2] SUN, S. et al. Renewable and Sustainable Energy Reviews, 169, p. 112918 (2022)
- [3] VENTURINI, S. et al. ACS Catalysis, 13, p. 10835-10845 (2023)