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# Electrochemical Ammonia Synthesis Using BZCYYb4411

## Electrolyte and Ag Electrolyte

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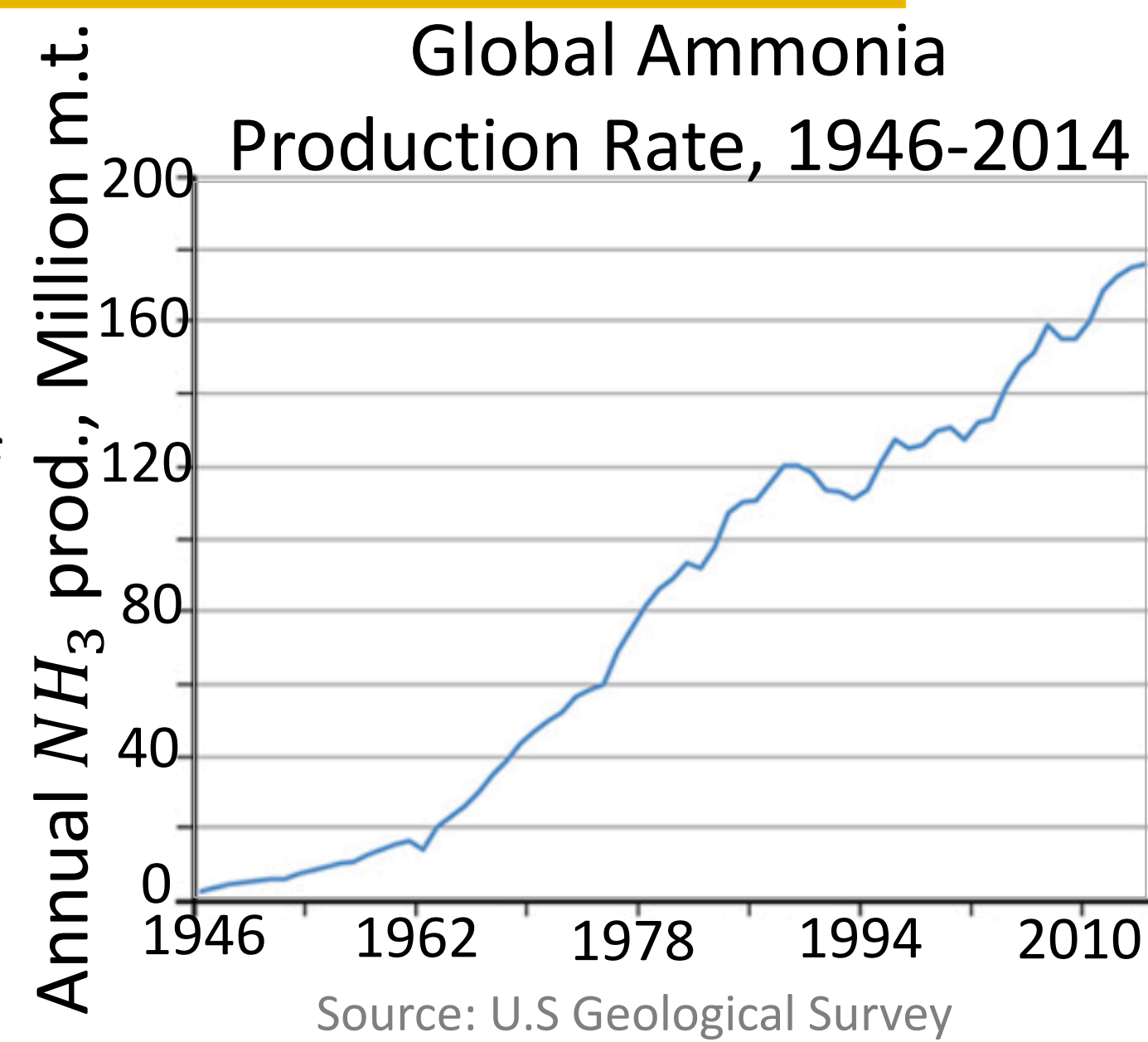
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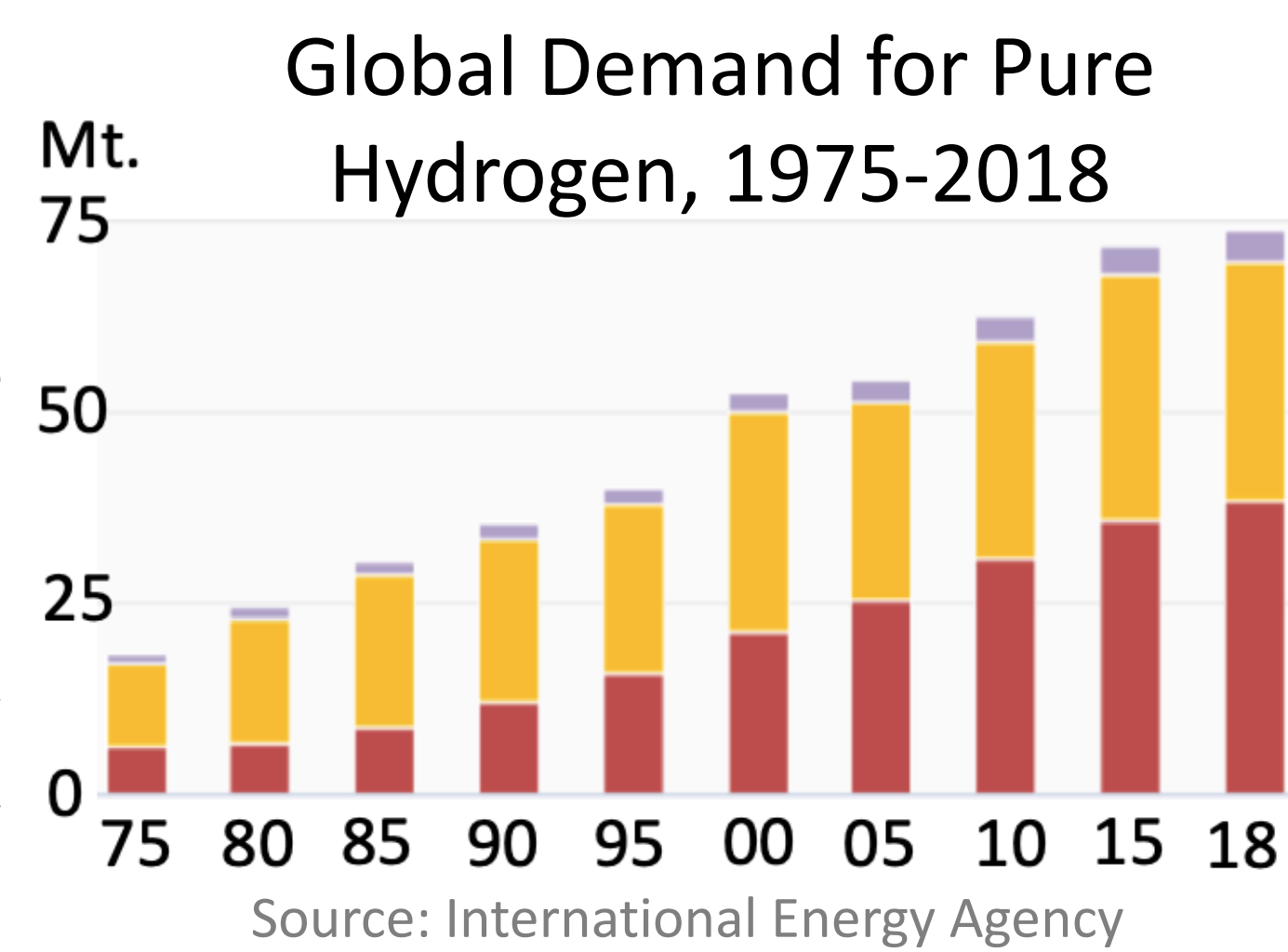
### Background & Motivation

- Ammonia plays a crucial role in the production of fertilizers, cleaning products, gas refrigerants, explosives, and more.
- In 2018, approximately 88% of apparent domestic ammonia consumption was for fertilizer use.
- Current methods for producing ammonia contribute greatly to carbon dioxide emissions.



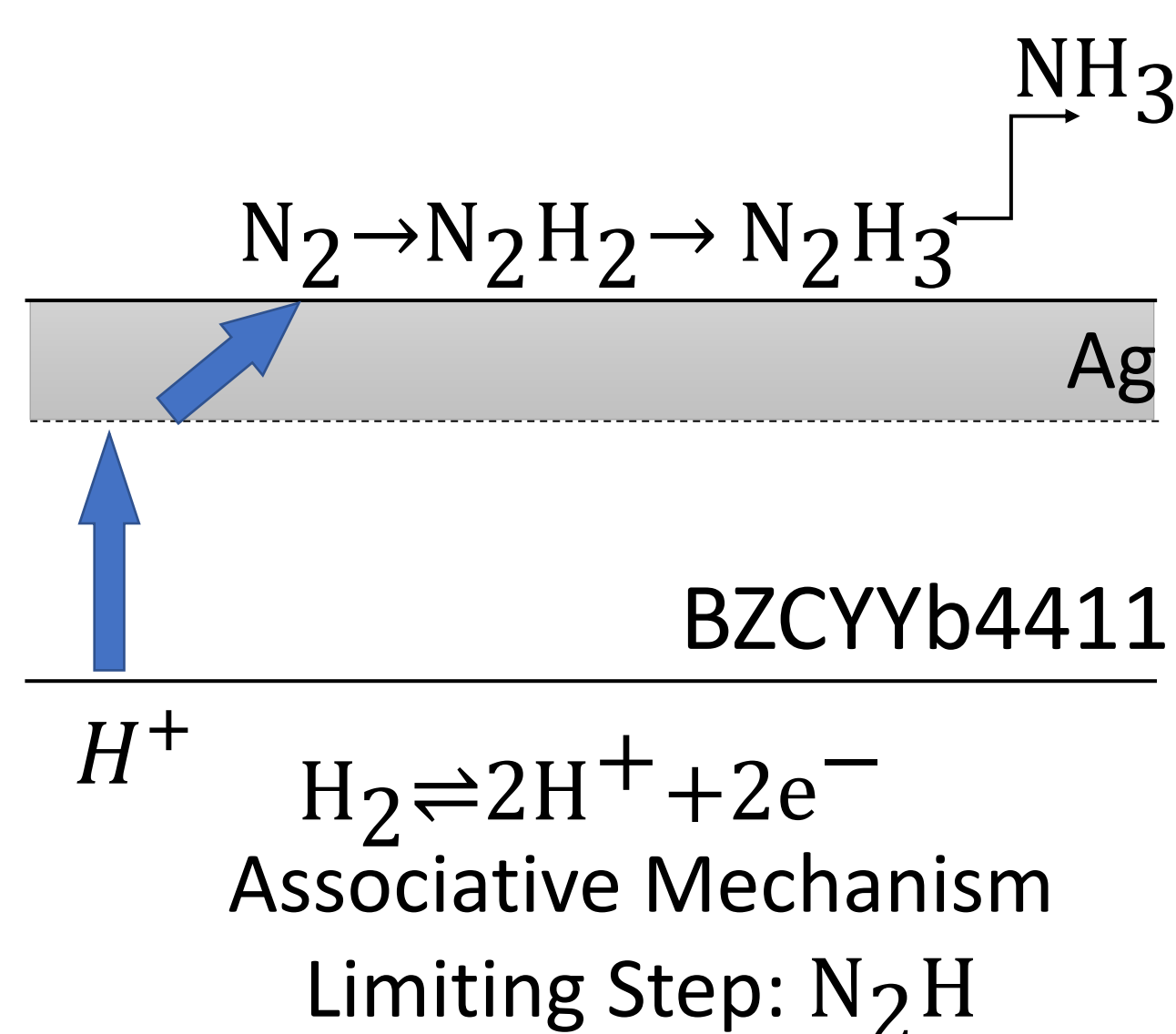
### Ammonia as an Energy Carrier

- Ammonia contains 17.6 wt.% hydrogen and can be used as a storage for hydrogen having significant advantages over conventional methods of storing and transporting hydrogen.
- Ammonia has a high energy density (4.3 kW h kg<sup>-1</sup>) and can be easily liquefied for transport.

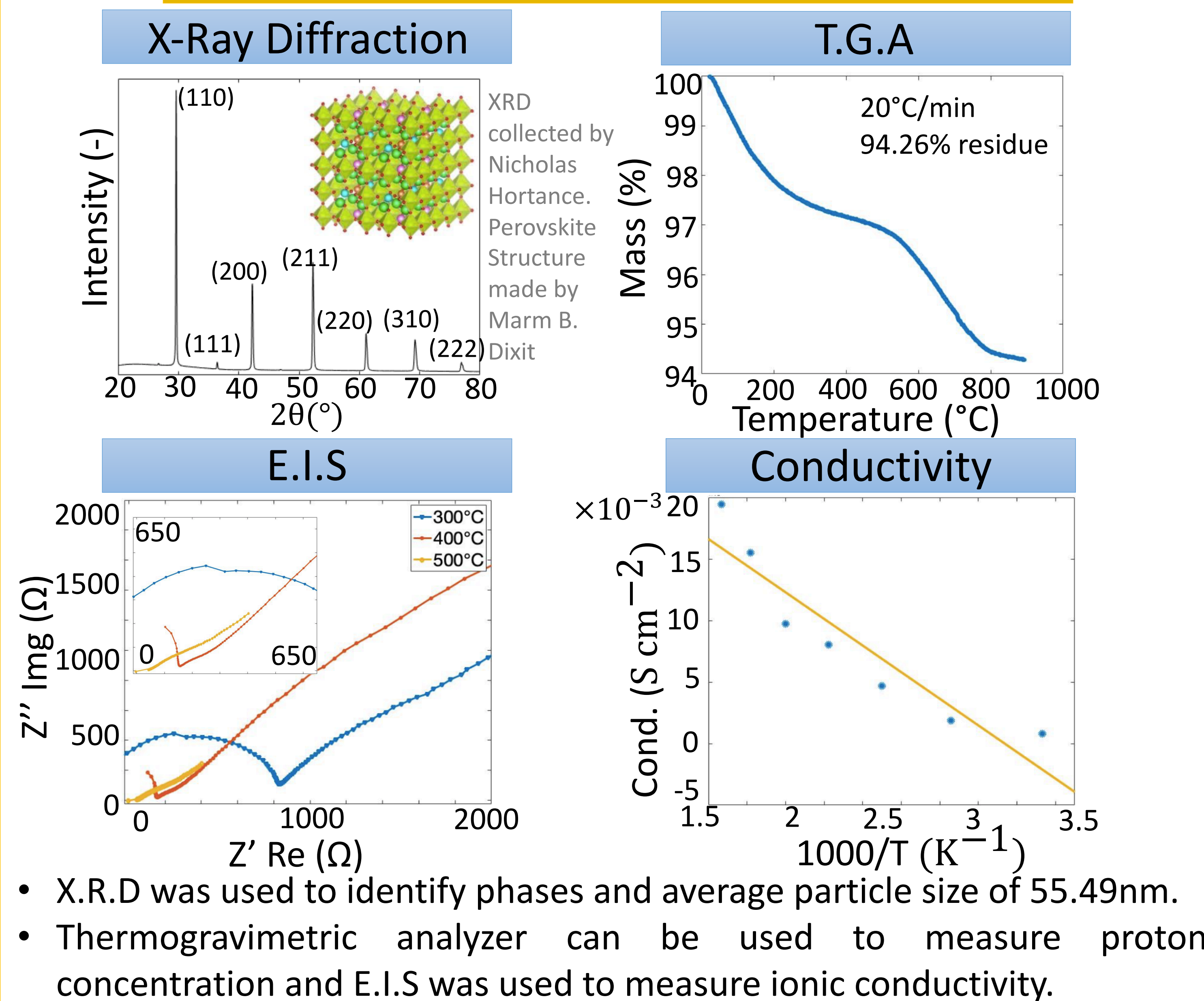


### Electrochemical Ammonia Synthesis

- Electrochemical production of ammonia using a solid electrolyte allows for the process to operate at ambient pressures and temperatures of 300-600°C with low voltages of 0.8-1.2V.
- Current production of ammonia uses the Haber Bosch process which operates under relatively extreme conditions of 250bars of pressure and at temperatures of 400-500°C with an iron-based catalyst.

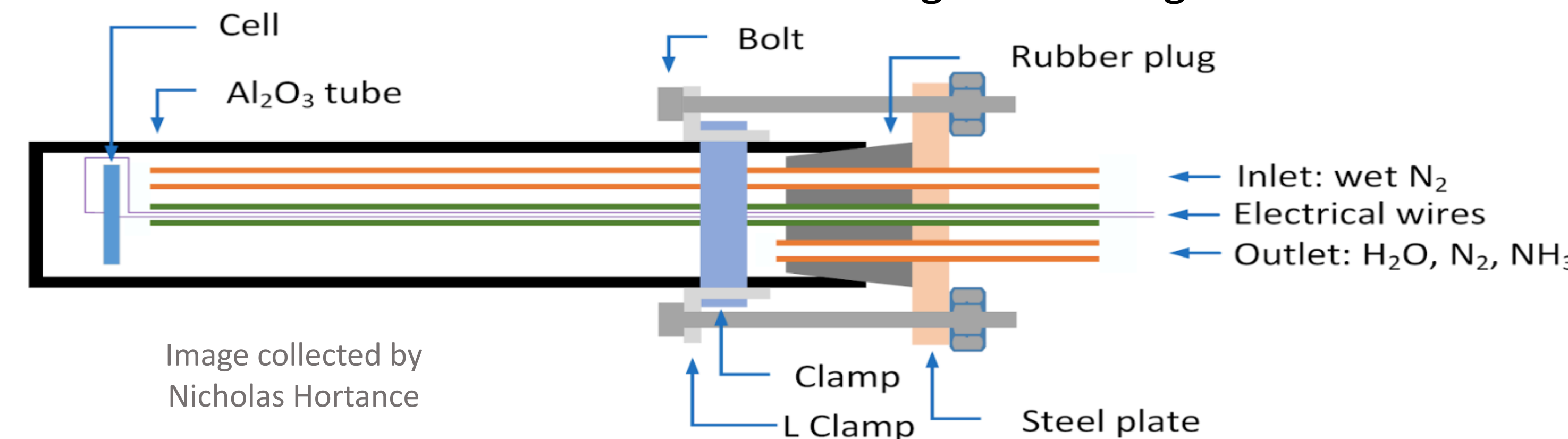


### Characterization

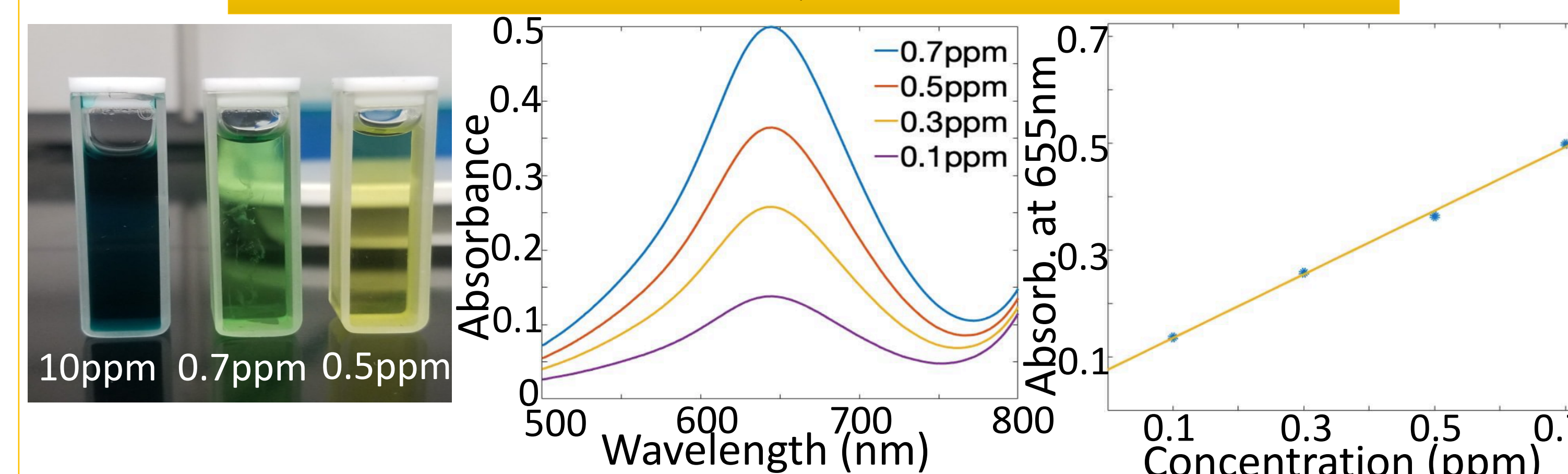


### Set-up

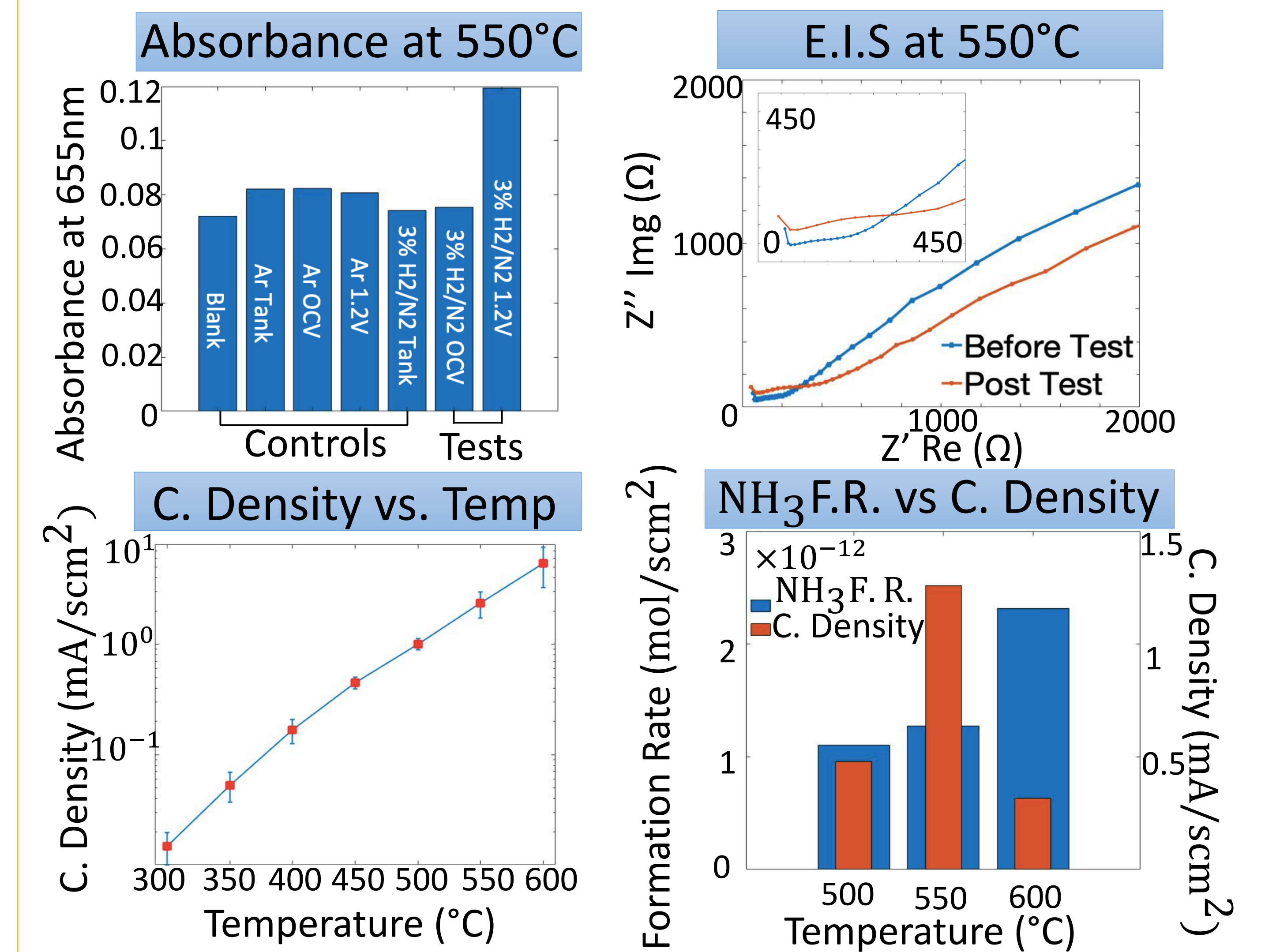
- An alumina single chamber reactor was placed in a tube furnace at ambient pressure and at temperatures of 500-600°C.
- 3% H<sub>2</sub>/N<sub>2</sub> gas and water vapor flow inside the reactor where nitrogen is adsorbed at the surface of the cell creating ammonia gas.



### Ammonia Quantification



### Results



### Conclusions and Future Works

- Ammonia was produced electrochemically using a solid electrolyte.
- Ammonia formation rates are similar to literary reports.
- Cyclic voltammetry could be used to further evaluate different electrocatalysts and different conditions to improve ionic conductivity and ammonia formation rates.

### References

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### Acknowledgements

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### Electrolyte Preparation

