Renewable Ammonia Electrochemical Synthesis by Glow Discharge With an Iron Based Catalyst

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Ammonia fertilizers feed over half of the global population. However, its synthesis through the Haber-Bosch process is extremely unsustainable, leading to over 20% of global chemical CO2 emissions. This project proposes a device that synthesizes ammonia in a sustainable, non-invasive, and cost-effective manner. Ultimately, being able to synthesize ammonia on demand and off-grid. The device circulates filtered atmospheric nitrogen along with hydrogen from electrolysis. Low-pressure glow discharge under magnetic confinement is used to break the nitrogen triple bond and form ammonia with an iron oxide catalyst. The device produces 2.28E-10 moles of ammonia per watt, has zero carbon emissions, has no chemical residue, produces satisfactory levels of sound (44.2dB), and is easily disassembled and transported. Future work will increase the yield of the device by the use of different catalysts and increasing the yield of hydrogen from electrolysis.

Awards Won:

Fourth Award of $600

Aramco: Second Place Prize Chemistry (CHEM) / Materials Science (MATS)