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Influences on the selective catalytic oxidation of residual ammonia in ammonia cracking gas

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The Federal Government of Germany assigns hydrogen in its national hydrogen strategy a "[…] central role in the further development and completion of the energy transition" [1] while acknowledging that "[…] the greater part of demand will have to be covered permanently by imports of hydrogen and its derivatives." [2] Green ammonia as a hydrogen carrier will play a significant role and the Federal Ministry for Economic Affairs and Climate Action recently signed the first delivery contract for green ammonia starting 2027. [3]
To use hydrogen after importing, the ammonia must be cracked. Due to the thermodynamic equilibrium of the reaction, the resulting product gas contains a residual amount of ammonia that must be removed for further gas separation and usage, especially in decentralized ammonia cracking plants. One possible technology for the purification of the product gas could be selective catalytic oxidation of the residual ammonia in a second reactor after the cracker, which shall be experimentally proven in this project. The pilot plant ammonia cracker for this project works between 750 °C and 950 °C and between atmospheric pressure and 10 bar. In a past catalyst study, different catalysts were examined for their performance at different reaction temperatures and residence times to determine one preferable catalyst for future experiments and process trials.
In this study the best performing catalyst from the previous one was used in further ammonia oxidation experiments to determine its usability and performance for the proposed process. A set of experiments varying GHSV, reaction temperature, pressure, oxygen and ammonia content were performed in a laboratory reactor. At low pressures and corresponding low ammonia contents, a full conversion of residual ammonia from the cracking gas was possible. Further experiments show promising results for the technical feasibility of the SCO-process. The results of this study will be used to scale up the laboratory reactor to pilot plant scope.

References:

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