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SUMMARY OF THE DOCTORAL THESIS

REDUCTION OF N_2O CONCENTRATION IN EXHAUST GASES FROM THE NITRIC ACID PLANT

The main purpose of the doctoral dissertation was to develop technological assumptions for the design of a low-temperature nitrogen oxide (I) (N_2O) decomposition unit in the TKV nitric acid plant at Grupa Azoty ZAK S.A. The conducted research was focused on the practical aspect. It was assumed that the obtained results will constitute the basis for the first Polish implementation of the low-temperature N_2O decomposition technology.

The doctoral thesis was divided into two parts. The theoretical part describes the impact of greenhouse gases on the global warming effect and the environment. Physical and chemical properties, sources and scale of N_2O emission are presented. Political and legal conditions affecting the European Union Emissions Trading System (EU ETS) were also presented. Issues related to plants for the production of nitric acid as a source of nitric oxide (I) formation were characterised, and the essence and the physicochemistry of the nitric acid production process were described. In addition, the influence of the most important parameters on the production of nitric acid was determined.

The experimental part describes the materials and research methods used in this work. In addition, the project and construction of the plant for low-temperature N_2O decomposition on the shunt of the industrial nitric acid (V) plant located in Grupa Azoty ZAK S.A. was presented. Assumptions for the construction of an industrial reactor were formulated, based on the results obtained from the conducted research. A mass and heat balance for the DeNOx node was prepared, which included the construction of a new reactor for low-temperature N_2O decomposition, and then an efficiency analysis was carried out, which enabled determination of the conditions and possibilities of commercial implementation of a low-temperature N_2O decomposition node in nitric acid (V) production plants.

The obtained test results allowed for a full assessment of the operation of the catalyst and the low-temperature N_2O decomposition node, in conjunction with the DeNOx reactor, in real conditions and to determine the impact of process parameters on the achieved N_2O emission reduction effect. The implementation of the main objectives of the thesis made it possible to achieve the 8th TRL technological readiness level of the proposed solution.