The effect of the operation parameters on the performance of an industrial Ammonia oxidation reactor

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Nitric acid production is one of the large-scale processes in chemical industry. It is one of the most essential bulk chemicals to produce fertilizer, explosives and dyes. Ammonia oxidation with air over (platinum/rhodium) gauzes is the first stage of nitric acid production. To be able to analyze and optimize the operation of a plant, one must first have a mathematical model describing the real behavior of the process. The modeling of a plant can be done in many alternative ways; one can utilize the physical and chemical relationships on which the process is based on, or one can try to find the model experimentally. So we can have different models for the same process. Most of mathematical models of Catalytic ammonia oxidation process were developed for micro reactors. Mathematical models were used for simulating the industrial ammonia oxidation reactor, describing the effect of external conditions such as, (inlet temperature, inlet pressure, inlet composition of gas mixture,....) on the performance of the reactor, but there aren't models for describing the variation of concentration of gas species along the catalyst bed, and the effect of void fraction of the catalyst bed on the performance of the reactor. So, the objective of the present work is to find an appropriate mathematical models for an industrial reactor for the oxidation of ammonia on Pt-Rh gauzes, which show the variation of concentration for gas species, and temperature along the height of catalyst bed, and also show the effect of void fraction of Pt/Rh catalyst on the performance of the reactor. The sensitivity analysis for these models was also studied.

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