Thermal Modeling of Radiation and Convection Sections of Primary Reformer of Ammonia Plant

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Abstract

The primary reformer is basically a furnace containing burners and tubes packed with supported nickel catalyst. Due to the strongly endothermic nature of the process, a large amount of heat is supplied by fuel burning (commonly natural gas) in the furnace chamber. Accordingly, selection of primary reformer operating parameters has an important influence on reduction of operating costs and increasing the reactor performance (conversion efficiency).

In this paper, the radiation and convection sections of primary reformer are investigated. The effects of key parameters on reformer performance are studied and the related developed software program is presented. The stirred-reactor furnace model which was used to simulate the radiation section of primary reformer was found to make substantially correct predictions of the overall heat transfer process in the furnace.

Comparison of the numerical data obtained from the simulation program with the measured data collected from primary reformer of Razi Petrochemical Plant showed a mean difference of 0.23% in estimating produced hydrogen mole fraction, as well as 1.7% and 7.25% in computing the outlet temperature of process fluids and induced draft fan (ID) speed, respectively.

Keywords: "Thermal modeling, Heat transfer, Radiation, Steam reforming, primary reformer, Catalytic reactor, Ammonia plant"

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