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System Modeling for Ammonia Synthesis Energy Recovery System GABRIELA BRAN ANLEU, PIROUZ KAVEHPOUR, ADRIENNE LAVINE, University of California, Los Angeles, AMMONIA THERMOCHEMICAL ENERGY STORAGE TEAM — An ammonia thermochemical energy storage system is an alternative solution to the state-of-the-art molten salt TES system for concentrating solar power. Some of the advantages of this emerging technology include its high energy density, no heat losses during the storage duration, and the possibility of long storage periods. Solar energy powers an endothermic reaction to disassociate ammonia into hydrogen and nitrogen, which can be stored for future use. The reverse reaction is carried out in the energy recovery process; a hydrogen-nitrogen mixture flowing through a catalyst bed undergoes the exothermic ammonia synthesis reaction. The goal is to use the ammonia synthesis reaction to heat supercritical steam to temperatures on the order of 650°C as required for a supercritical steam Rankine cycle. The steam will flow through channels in a combined reactor-heat exchanger. A numerical model has been developed to determine the optimal design to heat supercritical steam while maintaining a stable exothermic reaction. The model consists of a transient one dimensional concentric tube counter-flow reactor-heat exchanger. The numerical model determines the inlet mixture conditions needed to achieve various steam outlet conditions.

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