CHE 302 CHEMICAL KINETICS AND REACTOR DESIGN
FALL 2019, PROJECT
Due: January 10th, 2020, 4:30 Pm

PROJECT

The vapor-phase cracking of acetone to ketene and methane is

$$CH_3COCH_3 \rightarrow CH_2CO + CH_4$$

The reaction is first-order with respect to acetone and the reaction rate can be expressed by

$$lnk = 34.34 - \frac{34222}{T}$$

where k is in reciprocal seconds and T is in kelvin. In this design project, you are asked to design a plug flow reactor which contains of a bank of 1000 1-inch Sc. 40 tubes. The feed is pure acetone with a mass flow rate of $8000\ kg/h$. Consider two cases:

1. The reactor is operated adiabatically.
2. The reactor is surrounded by a heat exchanger where the heat-transfer coefficient is $110\ J/(m^2.s.K)$, and the ambient temperature is $1150\ K$.

The inlet temperature and pressure are the same for both cases at $1035\ K$ and $162\ kPa$, respectively. The enthalpy of reaction and heat capacity of species vary with temperature. Plot the conversion and temperature along the length of the reactor for both cases. Compare and evaluate your results.