

Module 4: Heat confinement

Exercise 1

A reactive resin is to be discharged from a reactor to drums (radius 0.3 m, height 0.9 m). In order to obtain a low viscosity allowing a practicable transfer time, the discharge temperature should be above 75° C. It is known that the heat release rate of the resin is 10Wkg^{-1} at 180°C and the activation energy of the reaction is 80kJmol^{-1} .

Data

$$\rho = 1100\text{kgm}^{-3}$$

$$\lambda = 0.1\text{Wm}^{-1}\text{K}^{-1}$$

$$c_p = 2100\text{J kg}^{-1}\text{K}^{-1}$$

$$\delta\epsilon = 2.37$$

Question

1. Is this operation thermally safe?
2. Is it safe at 90°C?

Exercise 2

An intermediate has to be stored liquid in drums (radius 0.3 m, height 0.9 m) at a temperature equal or above 40°C. A hot storage room at 50°C is available. The temperature of another storage room could be changed to 40°C, if necessary.

It is known that the heat release rate of the resin is 12Wkg^{-1} at 140°C and the activation energy of the reaction is 70kJmol^{-1} .

Data

$$\rho = 1000\text{kgm}^{-3}$$

$$\lambda = 0.1\text{Wm}^{-1}\text{K}^{-1}$$

$$c_p = 1800\text{J kg}^{-1}\text{K}^{-1}$$

$$\delta\epsilon = 2.37$$

Question

Is storage possible at 40°C and 50°C for 1 day, 1 week, 1 month?