國立成功大學 105 學年度碩士班招生考試試題

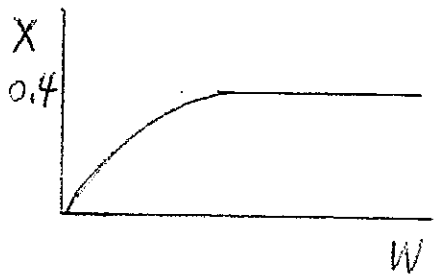
系　　所：生物醫學工程學系

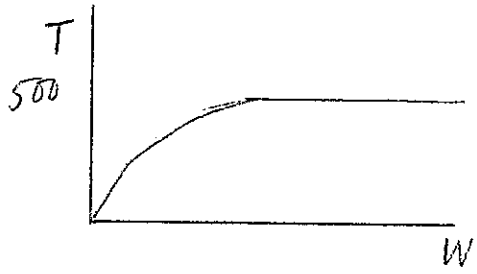
考試科目：化工反應工程

考試日期：0227，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. **(15%)** The species A and B react to form species C, D, and E in a packed bed reactor. The catalysis does not decay. The reaction is elementary. The following profiles were obtained.





Answer *true* or *false* for the following statements to this system

(a) The above profiles could represent an adiabatic system where the addition of inerts will increase the conversion.

(b) The above profiles could represent a system where decreasing the flow rate will increase the conversion.

(c) The above profiles could represent a system where if the feed temperature is increased, one cannot tell from the above profiles whether or not the conversion will increase or decrease.

(d) There could be a heat exchanger on the reactor for which the heat flow is

$$\frac{d\dot{Q}}{dW} = \frac{1000\ \text{kJ}}{\text{kg s K}}(T-500).$$

(e) The above equation may be an excellent candidate for reactor staging.

2. **(10%)** Two identical plug flow reactors are used to carry out two gas-phase reactors separately:

(a) $A \rightarrow 2B$

(b) $A \rightarrow B$

These two reactions have the same rate constant, and the feed conditions are the same in these two reactors. Without deriving any design equation, how do you judge which reactor will achieve the higher conversion.

3. **(15%)** The irreversible zero order gas phase dimerization

$$2A \rightarrow A_2$$

is carried out in a packed bed reactor with 5 kg of catalyst. The entering pressure is 10 atm and the exit pressure is 1 atm. Pure A enters at a flow rate of 10 mol/min. The reaction is zero order in A. k=1.5 mol/kg·min and T_0=500 K. What is the exit conversion?

4. For the elementary liquid phase reaction $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ in a CSTR with feed contains only A, please derive and plot:

(a) Concentration profile of B. **(7%)**

(b) Selectivity of B to C, as functions of space time τ in a CSTR. **(8%)**

(c) How do you determine the feed rate v_0 in order to maximize the selectivity of B to C? **(5%)**

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5. The gas phase irreversible reaction

$$A + B \rightarrow C$$

is elementary. The entering flow rate of A is 10 mol/min and is equal molar in A and B. The entering concentration of A is 0.4 mol/dm^3. k=2 dm^3/mol·min and T_0=500 K.

(a) What is the CSTR reactor volume necessary to achieve 90% conversion. **(10%)**

(b) What PFR volume is necessary to achieve 90% conversion. **(20%)**

6. **(10%)** A reversible exothermic reaction needs to be carried out in continuous-stirred tank reactors. The heat of reaction should be managed.

(a) Explain the importance of temperature controlling.

(b) Raise three practical methods to do the job, and explain how it works.