淡江大學 95 學年度碩士班招生考試試題

77

系別：化學工程與材料工程學系　　　科目：化學反應工程

准帶項目請打「V」	
V	簡單型計算機

本試題共 1 頁

1. Derive the differential and integral forms of the reactor design equations for the batch reactor, CSTR and PFR. You might get an algebraic form of equation for CSTR. Use the nomenclatures: N_j as the number of moles of species j in the reactor, r_j as the rate of formation of species j, V as the reactor volume, F_{j0} as the molar flow rate of species j into the reactor, F_j as the molar flow rate of species j out of the reactor, t as the time. (10%)

2. The elementary irreversible aqueous-phase reaction $A + B \rightarrow C + D$ is carried out isothermally as follows. Equal volumetric flow rates of two liquid streams are introduced into a 4-liter CSTR. One stream contains 0.020 mol/liter of A, the other 1.400 mol/liter of B. Some C is formed in the CSTR, its concentration being 0.002 mol/liter. The exit stream from the CSTR is then passed through a 16-liter PFR. Find the concentration of C at the exit of the PFR as well as the fraction of initial A that has been converted in the system. Hint: you may assume that the concentration of B is constant since the amount of B is excess through the whole process. (30%)

3. A reversible gas-phase elementary reaction $2A \leftrightarrow B$ is carried out at constant temperature. The feed consists of pure A at 340 K and 2 atm. The concentration equilibrium constant at 340 K is 10 dm^3/mol.
   (a) Calculate the equilibrium conversion of A in a constant-volume batch reactor. (15%)
   (b) Calculate the equilibrium conversion of A in a flow reactor with no pressure drop. (15%)

4. Consider a mixed-order elementary consecutive scheme

$$A \xrightarrow{k_1} B$$
$$A + B \xrightarrow{k_2} C$$

in an isothermal constant-volume batch reactor. The initial concentration of A is C_{A0} and B and C are not present in the reactor initially.
(a) Derive a relationship that will express C_B as a function of C_A. (15%)
(b) Derive a relationship that will express C_C as a function of C_B. (15%)