

材料科學與工程系 必修課程

課程名稱：	材料熱力學二
教科書名：	Thermodynamics of Materials, 5 th Ed. by D. V. Gaskell
參考書目：	1. Thermodynamics in Materials Science, by R. T. DeHoff 2. Thermodynamics of Solids, 2 nd Ed., by R. A. Swalin
建議先修課程：	1. 材料熱力學一 或 理工科系熱力學

大綱與進度 (請詳列章節細目)

第一週	Ch.1~8 Review of fundamental Thermodynamics(I): 1.Scope of Materials Thermodynamics, 2.Laws of Thermodynamics, 3.Definitions of thermodynamic functions and some important parameters, 4.Variation of V, S, H, G as a function of T, P.
第二週	Ch.1~8 Review of fundamental Thermodynamics(II): 1.Calculation of S, H, G and ΔS , ΔH , ΔG for temperature changes at constant P, 2.Application of Gibbs-Helmholtz Eq., Clapeyron Eq., Clausius-Clapeyron Eq, 3.G(T,P) for a single phase substance and two-phases equilibrium.
第三週	Ch.1~8 Review of fundamental Thermodynamics(III): 1.Thermodynamics of ideal and real gases, 2. Thermodynamics of mixing of ideal gases: definitions of partial molar quantities, calculations of ΔS_{mix} , ΔU_{mix} , ΔH_{mix} , ΔG_{mix}
第四週	Ch.9 Behavior of solutions(I): 1.Raoult' s law and Henry' s law, 2.Activity of a component in solution, 3.Gibbs-Duhem equation, 4.Relation between G and \bar{G}_i of binary solution, 5. Relation between a_i and $\Delta \bar{G}_i$, ΔG^M , 6. Method of graphical determination of $\Delta \bar{G}_i$ from ΔG^M
第五週	Ch.9 Behavior of solutions(II): 1.Properties of ideal solution, 2.Nonideal solution, 3.Application of Gibbs-Duhem equation (1-2).
第六週	Ch.9 Behavior of solutions(III): 1. Application of Gibbs-Duhem equation(3), 2.Regular solution, 3.Non-regular solution
第七週	Ch.9 Behavior of solutions(IV): 1.Quasi-chemical model of solutions, 2.Calculation examples.

第八週	Ch.10 Binary phase Diagrams and $\Delta G^M (X_B)$ curves(I): 1. $\Delta G^M (X_B)$ curve of a homogeneous solution, 2. $\Delta G^M (X_B)$ curve of a regular solution, 3. Criterion for phase stability in regular solution.
第九週	1. Mid-term exam, 2. Ch.10 Binary phase Diagrams and $\Delta G^M (X_B)$ curves(II): Standard states and two-phases equilibrium.
第十週	Ch.10 Binary phase Diagrams and $\Delta G^M (X_B)$ curves(III): 1. Isomorphous phase diagram, 2. Binary phase diagrams with liquid and solid exhibiting regular solution,
第十一週	Ch.10 Binary phase Diagrams and $\Delta G^M (X_B)$ curves(IV): 1. Eutectic phase diagrams. 2. Monotectic phase diagram, 3. Calculation examples.
第十二週	Ch.11 Reactions involving gases(I): 1. Reaction equilibrium in gas mixture and equilibrium constant, 2. Effect of temperature on K_p , 3. Effect of total pressure on K_p .
第十三週	Ch.11 Reactions involving gases(II): 1. Reaction equilibrium in $SO_2-SO_3-O_2$ system, 2. To keep a constant p_{O_2} through gas mixture of SO_2/SO_3 , CO/CO_2 , H_2/H_2O .
第十四週	Ch.11 Reactions involving gases(III): Calculation examples. Ch.12 Reactions involving gases and pure condensed phases(I): 1. Reaction equilibrium in a system containing pure condensed phases and gas phases. 2. Variation of "Standard Gibbs free energy change" with T.
第十五週	Ch.12 Reactions involving gases and pure condensed phases(II): 1. Ellingham Diagrams, 2. Stability of metals and metal-oxides.
第十六週	Ch.12 Reactions involving gases and pure condensed phases(III): 1. Effect of phase transition, 2. Stability of oxides in H_2/H_2O gas mixtures. 3. Nomographic scale of H_2/H_2O
第十七週	Ch.12 Reactions involving gases and pure condensed phases(IV): 1. Stability of oxides in CO/CO_2 gas mixtures, 2. Upper limit of (p_{CO}/p_{CO_2}) at a fixed T, 3. Calculation examples.