**Academic Identity and Industrial Role of materials science and engineering(MSE)**

Materials properties (mechanical, functional, structural, and chemical /physical reactivity) are mostly related to their crystal structure and own defects (intrinsic/extrinsic).

Structural defects and reactivity of a crystal materials system at *T≧ 0K* are inevitable according to “thermodynamic 3rd law” (*S0K* = 0 or *ΔS0K* = 0)

Their quantification could be understood and determinable by the “Gibbs equilibrium principle (*dGT* ≦ 0)” derived from “materials thermodynamic” 2nd law (*dSisolate* ≧0) coupled with 1st law (*dU* = *δQ* -*δW*) for a closed, isothermal materials system.

Thermodynamics forms(provides) the fundamental knowledge basis for consolidating academic and research fields of MSE, and thus justifies uniquely naming ‘science’ as the department identity among various departments of engineering college

Materials engineer and scientist are to manipulate the formation reaction mechanism and equilibrium quantities for specific defects in a crystal, and reactants/products of a concerned reaction. Also, they could determine thermodynamically the major process-variables influencing the equilibrium state of various reactions and optimize efficiently materials processing systems. Thus, they could possess capability to design and develop the advanced materials process for plant and industrial-scale applications.

This goal could be achieved by utilizing thermodynamic equilibrium principle as a first principle, coupled with process-kinetic information (transport phenomena and chemical reaction rate).

Process related-irreversibility and equilibrium state can be determined solely by considering thermodynamics, but its optimization/economic efficiency can be achieved by further studying the process kinetics, of which chemical driving force and temperature dependency are associated with classical/statistical equilibrium thermodynamics.

***MSE is truly regarded as a thermodynamics (science)-based engineering department***