Introduction to Materials Science

Syllabus Number 2D101
Basic Major Subjects
Elective Requisites 2 credit

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1. Course Description

Materials science will be related broad range of engineering products such as automobile, airplane, rocket, space craft and mobile phone. Phase transformation (solid, liquid and gas phases) is one of the common phenomena in the all materials. Materials science has been developed by understanding both common phenomena and specificity of materials. Studies of crystal structures and phase diagrams are essential. Student studies covalent, ionic and metal bondings. Furthermore, atoms move to their position by so called diffusion. Phase diagrams have been visualize the complex phase change of solution as a function of composition and temperature, based on the thermodymamics. Many kinds of materials have been produced and utilized in our society, these materials are rationalize by their phase diagrams. Steels, aluminum alloys and titanium alloys will be discussed. This course will be gain knowledge and method related to DP1 and DP2.

2. Course Objectives

The objectives of this course are to understand technical term of materials science and to get basic knowledge of concepts of it. For mechanical designer, they have to select the most appropriate materials by themselves in the machine design. In that case, engineer must have the complete knowledge of materials or get advice by materials researchers.

3. Grading Policy

Final examination (80%), brief tests (20%)

4. Textbook and Reference

Textbook
Y. Watanabe et.al. Zu de yokuwakaru kikaizairyougaku Korona Pub. ISBN978-4-339-04605-2

5. Requirements(Assignments)

Lecture note will be opened in LMS. Exercise in the textbook will be assigned.

6. Note

7. Schedule

[1] Crystal structure 1 : Atom and Atomic force, categorize crystal structure
[2] Crystal structure 2 : Crystal structure of pure metals
[3] Crystal structure 3 : Millar index of cubic structure
[4] Crystal structure 4 : Structure of ionic crystal
[5] Diffusion 1 : Fick's first law and second law
[6] Diffusion 2 : Interdiffusion and Kirkendall effect
[7] Phase transformation single component system (pressure - temperature diagram)
[8] Essence of thermodynamics (ideal gas equation and Dalton's law of partial pressure
[9] Gibb's free energy of ideal solution
[10] Binary equilibrium phase diagram (complete solid solution) and lever rule
[11] Binary equilibrium phase diagram (eutectic)
[12] Fe-Fe3C binary phase diagram and many kinds of steel
[13] Al-Cu binary phase diagram and Duralumin
[14] Titanium alloys and Nickel base super alloys
[15] Final examination and summaries