

Engineering of Aerospace Surface Treatment

Syllabus Number

2D205

Special Subjects

Elective 2 credit

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1. Course Description

In aircraft and space equipment, special materials for which maximum specific strength has been sought are used, and as a result of the strict requirements for reliability and safety, the surface treatments employed require techniques of a different nature to those for consumer products such as car parts and home electronics. In this course, after first using the textbook to acquire fundamental knowledge of surface treatment, including what surface treatment is and the basic knowledge of general surface treatments and related techniques, the techniques of aerospace surface treatment will be studied using photographs (of surface treatment processes, etc.) of actual jet engines, landing gear, etc. with which aircraft such as the Boeing 747 (Jumbo Jet) are equipped.

2. Course Objectives

In this course, first using the textbook to acquire fundamental knowledge of surface treatment, including what surface treatment is and the basic knowledge of general surface treatments and related techniques, then the techniques of aerospace surface treatment will be studied using photographs (of surface treatment processes, etc.) of actual jet engines, landing gear, etc. with which aircraft such as the Boeing 747 (Jumbo Jet) are equipped.

3. Grading Policy

Performance is evaluated based on in-class quizzes (30%) and periodic examinations (70%). Overall feedback is provided and test answers are explained during the final lecture.

4. Textbook and Reference

Textbook

Textbook: 仁平宣弘、三尾 淳 共著 『はじめての表面処理技術』 技術評論社 ISBN978-4-7741-5058-1

Course material: Reference material will be distributed as needed.

5. Requirements(Assignments)

Before class: Read in advance the scope of the next lecture in the designated textbook, and sort out the points that you do not understand or have issues with before attending the class. (1 hour)

After class: Summarize the “specialist terminology” and “principles and applications of various surface treatment technologies” studied in this course in the dedicated notebook and revise. (2 hours)

6. Note

Prepare the special notes for this class and a scientific calculator (required when doing the quizzes).

7. Schedule

- [1] What is surface treatment (concept of surface treatment, types and overview of surface treatments, aims and effects of surface treatment)
- [2] Basic knowledge of surface treatment (phase changes of matter, electrons and ions, plasma and the effects of its application)
- [3] Basic knowledge of surface treatment (electromagnetic waves and the effects of their application, vacuum and vacuum equipment)
- [4] Surface treatment by aqueous solution (chemical conversion treatment, electroless plating)
- [5] Surface treatment by aqueous solution (electroplating, anodization)
- [6] Surface treatment by physical vapor deposition (vacuum deposition, ion plating, sputtering, creating DLC films)
- [7] Surface treatment by chemical vapor deposition (thermal CVD, plasma CVD, optical CVD, creating diamond films)
- [8] Surface treatment by ion beam (ion beam deposition, ion beam sputtering, ion implantation)
- [9] Surface treatment by fusion (what is thermal spraying, types and features of thermal spraying methods, thermal spraying materials, thermal spraying films)
- [10] Surface treatment in jet engines (case study of application of atmospheric plasma thermal spraying)
- [11] Surface treatment in jet engines (case study of application of reduced pressure plasma thermal spraying)

- [12] Surface treatment of aircraft landing gear (landing gear material, hydrogen embrittlement failure, landing gear repair work)
- [13] Surface treatment of aircraft landing gear (partial nickel plating, hard chrome plating, cadmium-titanium plating)
- [14] Surface treatment of helicopter blade protectors (manufacturing technology using hard nickel electroforming)
- [15] Test, summary