

Lecture: Novel technologies in surface engineering
Year 3
prof. Bogusław MAJOR

The course covers the following topics:

- 1. Scope of „surface engineering”**
- 2. Modern methods of fabrication of technological surface layers**
- 3. Pressure units**
 - a. Vacuum**
- 4. Mechanical methods of surface modification**
- 5. Chemical methods of surface modification CVD (chemical vapour deposition)**
- 6. Solidification from the gaseous phase**
- 7. Plasma**
- 8. Physical methods of surface modification PVD (physical vapour deposition)**
- 9. Ion-electron interaction with solid surface**
- 10. Laser beam-solid surface interaction**
- 11. Magnetron discharge in plasma processing**
- 12. Surface modification by ion interaction**
- 13. Surface modification by plasma ion implantation**
- 14. Surface modification by low-energy and high-current elektron beam**
- 15. Surface modification by laser remelting and alloying**
- 16. Laser rapid prototyping**
- 17. Pulsed laser deposition using laser ablation**
- 18. Surface cleaning by laser ablation**
- 19. Surface modification by thermal plasma**
- 20. Arc evaporation**
- 21. Methods of surface diagnostics**
 - a. spectroscopic methods**
 - b. structural (AFM, SEM, TEM)**
 - c. residual stress and methods of measurements**
 - d. micro-mechanical properties**
- 22. Hard and super hard coatings on the basis of: nitrides, carbides, borides and nano-composites**
- 23. Surface thermal barriers**
- 24. Polymer coatings fabricated by plasma polymerisation**
- 25. Trends in surface engineering in the world**

Multicomponent, nanostructured and functionally graded coatings or thin films may exhibit unique physical, mechanical, chemical properties ensuring remarkable degradation resistance where the surface protection of materials against wear, corrosion, friction is a key issue. A broad overview on modern coating and thin-film deposition technique is presented. The major aim of these lectures is to show and discuss various problems of physics and chemistry involved in the production, characterization and applications of coatings and thin films, which can be variously hard and wear resistant. Attention is paid at the bio-medical coating for tissue contacting materials. A balance is found between fundamentals aspects and experimental results illustrating various models, mechanisms and theories. New trends and new results are also evoked to have an overlook about future developments and applications.

The course is based on:

M.Ashby: Materials; engineering, science, processing and design, Elsevier 2010

Y.Pauleau: Materials Surface Processing by Directed Energy Techniques, Elsevier 2006

T.Burakowski, T.Wierzchoń: Inżynieria powierzchni metali, Wyd.nauk.-Techn. 1995

M.Blicharski: Wstęp do inżynierii materiałowej, Wyd. Nauk.-Techn. 2003

L.A.Dobrzański: Metalowe materiały inżynierskie, Wyd. Nauk.-Techn., 2004

A.Mazurkiewicz: Nanonauki i Nanotechnologie, Wyd.Inst.Technol.Ekspl., Radom 2007