



# Satuan Acara Pengajaran

ENMT801016 - Rekayasa Permukaan Material Lanjut

Pengajar

*Nofrijon Bin Imam Sofyan Ph.D*

## Tujuan Perkuliahan

1. Menjelaskan hal-hal yang berkaitan dengan perubahan sifat bahan akibat perlakuan rekayasa permukaan 2. Memilih dan mendesain berbagai perlakuan permukaan sesuai dengan bahan yang dipilih dan aplikasinya di dunia industri 3. Mendapatkan mikrosutruktur yang tepat sesuai dengan yang diinginkan sesuai dengan jenis perlakuan permukaan yang dipilih

## Minggu 1

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<b>Materi</b>	Class Introduction General Rules Grading Class Outline Teamwork Learning Simulation
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<b>Media</b>	LCD Projector
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<b>Referensi</b>	Karl-Erik Thelning, 'Steel and its heat treatment,' Butterworths, 1984. ASM Handbook Vol. 4; Heat Treating, ASM International, Ohio, USA, 1991. ASM Handbook Vol. 5; Surface Engineering, ASM International, Ohio, USA, 1994. Rointan F. Bunshah: Handbook of Hard Coatings, Deposition Technologies, Properties and Applications, Noyes Publications, Park Ridge, New Jersey, 2001. Hugh O. Pierson: Handbook of Chemical Vapor Deposition (CVD) Principles, Technology, and Applications, Noyes Publications, Park Ridge, New Jersey, 1999. Arthur A. Tracton: Coatings Technology Handbook, CRC Press Taylor & Francis Group, Boca Raton, 2006.
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**Aktivitas**      Lecture  
                         Group discussion

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## Minggu 2

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**Materi**            Fundamental of Surface Engineering:  
                         - Part Surface Requirements  
                         - Selecting surface technologies  
                         - Processes for surface treatment  
                         - Classification of surface engineering

Quiz

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**Media**            LCD Projector

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**Referensi**        ASM Handbook Vol 4: Heat Treating, ASM International, Ohio, USA, 1991.  
                         ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA,  
                         1994.

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**Aktivitas**        Lecture  
                         Quiz

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## Minggu 3

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**Materi**            Surface Cleaning:  
                         - Factors in selection  
                         - Cleaning options: Mechanical, Chemical, Biological  
                         - Inhibitors

**Media**            LCD Projector

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**Referensi**        Rointan F. Bunshah: Handbook of Hard Coatings, Deposition Technologies,  
                         Properties and Applications, Noyes Publications, Park Ridge, New Jersey, 2001.  
                         Hugh O. Pierson: Handbook of Chemical Vapor Deposition (CVD) Principles,  
                         Technology, and Applications, Noyes Publications, Park Ridge, New Jersey,  
                         1999.  
                         Arthur A. Tracton: Coatings Technology Handbook, CRC Press Taylor &  
                         Francis Group, Boca Raton, 2006.

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**Aktivitas**        Lecture  
                         Problem-based learning

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## Minggu 4

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**Materi** Team Work Problem-Based Learning  
- Material Failure  
- Failure Analysis  
- Self assessment  
- Group Assessment

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**Media** LCD Projector  
Laptop

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**Referensi** Rointan F. Bunshah: Handbook of Hard Coatings, Deposition Technologies, Properties and Applications, Noyes Publications, Park Ridge, New Jersey, 2001.  
Hugh O. Pierson: Handbook of Chemical Vapor Deposition (CVD) Principles, Technology, and Applications, Noyes Publications, Park Ridge, New Jersey, 1999.  
Arthur A. Tracton: Coatings Technology Handbook, CRC Press Taylor & Francis Group, Boca Raton, 2006.

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**Aktivitas** Group Discussion  
Class Discussion

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## Minggu 5

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**Materi** Surface Finishing:  
- Tolerance, consistency  
- Surface quality  
- Surface texture  
- Surface integrity  
- Surface alterations  
- Cutting edges finishing  
- Non-abrasive finishing

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**Media** LCD Projector

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**Referensi** ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA, 1994.  
Helmi A. Youssef and Hassan El-Hofy: Machining technology: machine tools and operations, CRC Press Taylor & Francis Group, Boca Raton 2008  
J.T. Black and Ronald A. Kohser: DeGarmo's Materials and Process in Manufacturing, 10th Ed., John Wiley & Sons, Inc., Hoboken NJ, 2008

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**Aktivitas** Lecture

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## Minggu 6

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**Materi** Selected Traditional Surface Engineering:  
- Painting  
- Electroplating  
- Anodizing  
- Thermal and plasma spraying  
- Diffusion: Nitriding, carburizing, boriding  
- Selective: Flame and induction

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**Media** LCD Projector

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**Referensi** ASM Handbook Vol 4: Heat Treating, ASM International, Ohio, USA, 1991.  
ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA, 1994.

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**Aktivitas** Lecture

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## Minggu 7

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**Materi** Midterm

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**Media**

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**Referensi**

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**Aktivitas**

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## Minggu 8

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**Materi** Enhanced Surface Engineering:  
- Laser treatment  
- Physical vapor deposition  
- Chemical vapor deposition

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**Media** LCD Projector

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**Referensi** ASM Handbook Vol 4: Heat Treating, ASM International, Ohio, USA, 1991.  
ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA, 1994.

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**Aktivitas** Lecture

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## Minggu 9

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**Materi** Case Study:  
Surface Engineering and Their Characterization

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**Media** LCD Projector  
Laptop  
Journal

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**Referensi** Hitoshi Habuka and Masaki Tsuji: Surface & Coatings Technology 217  
(2013) 88-93

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**Aktivitas** Independent Learning and Problem Solving

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## Minggu 10

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**Materi** Physical vapor deposition  
- Principle of PVD  
- Two classes of PVD: Evaporation and Sputtering  
- Processes in PVD

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**Media** LCD Projector

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**Referensi** 1. ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA, 1994.  
2. A.A. Tracton: Coatings Technology Handbook, Taylor & Francis Group, Boca Raton, 2006  
3. R. F. Bunshah: Handbook of Deposition Technologies for Films and Coatings Science, Technology and Applications, Noyes Publications, Park Ridge, NJ 1994  
4. D. M. Mattox: Handbook of Physical Vapor Deposition (PVD) Processing Film Formation, Adhesion, Surface Preparation and Contamination Control, Noyes Publications, Westwood, NJ 1998

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**Aktivitas** Lecture

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## Minggu 11

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**Materi** PVD (Continued)  
- Evaporation PVD:  
- Thermal  
- Electron beam  
- Sputtering:  
- Reactive sputter  
- Cathodic arc  
Material treatment for PVD

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**Media** LCD Projector

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- Referensi**
1. ASM Handbook Vol 5: Surface Engineering, ASM International, Ohio, USA, 1994.
  2. A.A. Tracton: Coatings Technology Handbook, Taylor & Francis Group, Boca Raton, 2006
  3. R. F. Bunshah: Handbook of Deposition Technologies for Films and Coatings Science, Technology and Applications, Noyes Publications, Park Ridge, NJ 1994
  4. D. M. Mattox: Handbook of Physical Vapor Deposition (PVD) Processing Film Formation, Adhesion, Surface Preparation and Contamination Control, Noyes Publications, Westwood, NJ 1998
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**Aktivitas** Lecture

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## Minggu 12

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**Materi** Fundamental of Chemical Vapor Deposition

- Theoretical analysis
- Rate limiting
- Microstructure
- Equipment
- Reactions

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**Media** LCD Projector

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- Referensi**
1. A.A. Tracton: Coatings Technology Handbook, Taylor & Francis Group, Boca Raton, 2006
  2. R. F. Bunshah: Handbook of Deposition Technologies for Films and Coatings Science, Technology and Applications, Noyes Publications, Park Ridge, NJ 1994
  3. H. O. Pierson: Handbook of Chemical Vapor Deposition (CVD) Principles, Technology, and Applications, 2nd Ed., Noyes Publications, Park Ridge, NJ 1999
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**Aktivitas** Lecture

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## Minggu 13

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**Materi** Journal Reading:  
Chemical reaction engineering in the design of CVD reactors

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**Media** Internet  
Computer

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**Referensi** H. Komiyama!, Y. Shimogaki, Y. Egashira: Chem. Eng. Sci. 54 (1999) 1941-1957

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**Aktivitas** Reading the Prescribed Journal  
Quiz

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## Minggu 14

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**Materi** Journal reading:  
Understanding the chemical vapor deposition of diamond: recent progress

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**Media** Internet  
Computer

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**Referensi** J. E. Butler, Y. A. Mankelevich, A. Cheesman, JieMa, and M.N. R. Ashfold: J.  
Phys. Condens. Matter 21 (2009) 364201

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**Aktivitas** Reading, self-learning  
Case study

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## Minggu 15

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**Materi** Final examination

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**Media**

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**Referensi**

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**Aktivitas**

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