



# Satuan Acara Pengajaran

ENMT800005 - Karakterisasi Material + Lab

Pengajar

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*Nofrijon Bin Imam Sofyan Ph.D*

## Minggu 1

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**Materi**      Class introduction  
- About the class  
- Rules  
- Grading  
- Brainstorming

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**Media**        LCD Projector

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**Referensi**    1. C.R. Brundle, C.A. Evans, Jr., S. Wilson, Encyclopedia of Materials Characterization, Butterworth-Heinemann, Boston, 1992.  
2. B.D Cullity, Elements of X-ray Diffraction, Addison-Wesley Publishing Co. Inc., Massachusetts, 1978.  
3. ASM Metals Handbook, Vol 09 - Metallography and Microstructures  
4. ASM Metals Handbook, Vol 10 - Materials Characterization  
5. S. Amelinckx, D. van Dyck, J. van Landuyt, and G. van Tendeloo: Electron Microscopy Principles and Fundamentals, VCH Verlagsgesellschaft mbH, Weinheim (1997)  
6. F.A. Settle: Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall PTR (1997)

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**Aktivitas**    Lecture  
Problem solving

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## Minggu 2

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**Materi** Basic in Materials Characterization: Crystal Structure  
- Crystal system  
- Plane and direction  
- Atomic position  
- Exercise

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**Media** LCD Projector

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**Referensi** B.D. Cullity: Elements of X-ray Diffraction, 2nd ed., Addison-Wesley Publishing Company Inc., Reading, Massachusetts, 1978  
C. Hammond: The Basics of Crystallography and Diffraction, 3rd ed., Oxford University Press Inc., New York, 2009.  
R.J.D. Tilley: Crystals and Crystal Structures, John Wiley & Sons Ltd., Chichester, West Sussex, England, 2006  
W.D. Callister, Jr.. Fundamentals of Materials Science and Engineering, John Wiley & Sons, Inc., New York, 2001

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**Aktivitas** Lecture  
Exercise

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### Minggu 3

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**Materi** Basic in Materials Characterization: Crystal Symmetry  
- Bravais Lattice  
- Point Group  
- Space Group  
- Notation and Symbol  
- Exercise

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**Media** LCD Projector

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**Referensi** B.D. Cullity: Elements of X-ray Diffraction, 2nd ed., Addison-Wesley Publishing Company Inc., Reading, Massachusetts, 1978  
C. Hammond: The Basics of Crystallography and Diffraction, 3rd ed., Oxford University Press Inc., New York, 2009.  
R.J.D. Tilley: Crystals and Crystal Structures, John Wiley & Sons Ltd., Chichester, West Sussex, England, 2006  
W.D. Callister, Jr.. Fundamentals of Materials Science and Engineering, John Wiley & Sons, Inc., New York, 2001

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**Aktivitas** Lecture  
Lab preparation

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### Minggu 4

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**Materi** Basic in Materials Characterization: Stereographic Projection  
- Construction  
- Wulff Net  
- Zone Equation  
- Exercise

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**Media** LCD Projector

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**Referensi** B.D. Cullity: Elements of X-ray Diffraction, 2nd ed., Addison-Wesley Publishing Company Inc., Reading, Massachusetts, 1978  
C. Hammond: The Basics of Crystallography and Diffraction, 3rd ed., Oxford University Press Inc., New York, 2009.  
R.J.D. Tilley: Crystals and Crystal Structures, John Wiley & Sons Ltd., Chichester, West Sussex, England, 2006  
W.D. Callister, Jr.. Fundamentals of Materials Science and Engineering, John Wiley & Sons, Inc., New York, 2001

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**Aktivitas** Lecture  
Exercise

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## Minggu 5

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**Materi** Fundamental Concept in Materials Characterization  
- Fundamental of X-Ray Diffraction  
- Diffraction by a Crystal  
- Bragg's Law  
- Structural Factor  
- Exercise

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**Media** LCD Projector

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**Referensi** C. Hammond: The Basics of Crystallography and Diffraction, 3rd Ed., Oxford University Press, 2009.  
B. D. Cullity: Elements of X-ray Diffraction, Addison-Wesley Publishing Company, Inc., 1978.  
R.J. D. Tilley: Crystals and Crystal Structures, John Wiley & Sons Ltd., 2006

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**Aktivitas** Lecture  
Exercise

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## Minggu 6

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**Materi** Lab-1  
Preparation of Al - Zn systems:  
No Zn Al  
1 85.0 15.0  
2 77.7 22.3  
3 55.0 45.0  
4 20.0 80.0

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**Media** Lab coat  
Safety Google  
Lab equipment

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**Referensi** [1] Thaddesius B. Massalski (Ed), et al., Binary Alloy Phase Diagrams, 2nd Ed. Vol. 1 (1990) 239 ? 241.  
[2] S M&uuml;ller, L-W Wang and Alex Zunger, Modelling Simul. Mater. Sci. Eng. 10 (2002) 131 ? 145.  
[3] B. D. Cullity, Elements of X-Ray Diffraction, 2nd Ed., Addison-Wesley Publishing Co., Inc., Massachusetts (1978) 120, 350 ? 368.  
[4] P. Villars and L. D. Carvert, Pearson?s Handbook of Crystallographic Data for Intermetallic Phase, Metals Park OH: ASM (1985).  
[5] Theo Hahn (Ed.), International Tables for Crystallography, Vol. A Space-Group Symetry, IUCr, Kluwer Academic Publisher, (1995).

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**Aktivitas** Laboratorium activity: casting

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## Minggu 7

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**Materi** Lab-2  
X-Ray Diffraction:  
As-cast  
As-quench  
Quench-anneal

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**Media** Laboratory equipment  
XRD

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**Referensi** [1] Thaddesius B. Massalski (Ed), et al., Binary Alloy Phase Diagrams, 2nd Ed. Vol. 1 (1990) 239 ? 241.  
[2] S M&uuml;ller, L-W Wang and Alex Zunger, Modelling Simul. Mater. Sci. Eng. 10 (2002) 131 ? 145.  
[3] B. D. Cullity, Elements of X-Ray Diffraction, 2nd Ed., Addison-Wesley Publishing Co., Inc., Massachusetts (1978) 120, 350 ? 368.  
[4] P. Villars and L. D. Carvert, Pearson?s Handbook of Crystallographic Data for Intermetallic Phase, Metals Park OH: ASM (1985).  
[5] Theo Hahn (Ed.), International Tables for Crystallography, Vol. A Space-Group Symetry, IUCr, Kluwer Academic Publisher, (1995).

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**Aktivitas** Specimen Diffractogram from Lab-1

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## Minggu 8

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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 9

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**Materi** Metallography  
Specimen preparation  
Sectioning  
Mounting  
Grinding  
Polishing  
Etching

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**Media** LCD Projector

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**Referensi** 1. Kay Geels: Metallographic and Materialographic Specimen Preparation, Light Microscopy, Image Analysis and Hardness Testing, ASTM International, (2007)  
2. G&uuml;nter Petzow: Metallographic etching: techniques for metallography, ceramography, plastography, ASM International, Materials Park, OH, (1999)

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**Aktivitas** Lecture

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## Minggu 10

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**Materi** Lab-3  
SEM/EDX

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**Media** Lab equipment  
Prepared Specimen

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- Referensi**
1. S. Amelinckx, et al.: Electron Microscopy, Principles and Fundamentals, VCH Verlagsgesellschaft mbH, Weinheim, 1997.
  2. C Richard Brundle, Charles A. Evans, Jr., and Shaun Wihon: Encyclopedia of Materials Characterization, Butterworth-Heinemann, MA, 1992.
  3. S. J. B. Reed: Electron Microprobe Analysis and scanning electron Microscopy in Geology, Cambridge University Press, Cambridge, 2005.
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**Aktivitas** Microstructure and composition characterization

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## Minggu 11

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**Materi** Project Assignment:  
Microstructure and Lattice Parameters Change in Al - Zn Alloys

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**Media** Computer/Laptop

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- Referensi**
- [1] Thaddesius B. Massalski (Ed), et al., Binary Alloy Phase Diagrams, 2nd Ed. Vol. 1 (1990) 239 - 241.
  - [2] S M&uuml;ller, L-W Wang and Alex Zunger, Modelling Simul. Mater. Sci. Eng. 10 (2002) 131 - 145.
  - [3] B. D. Cullity, Elements of X-Ray Diffraction, 2nd Ed., Addison-Wesley Publishing Co., Inc., Massachusetts (1978) 120, 350 ? 368.
  - [4] P. Villars and L. D. Carvert, Pearson?s Handbook of Crystallographic Data for Intermetallic Phase, Metals Park OH: ASM (1985).
  - [5] Theo Hahn (Ed.), International Tables for Crystallography, Vol. A Space-Group Symetry, IUCr, Kluwer Academic Publisher, (1995).
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**Aktivitas** Journal Writing and Preparation

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## Minggu 12

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**Materi** Thermal Analysis  
- Introduction  
- Techniques in Thermal Analysis: TGA, DTA, DSC  
- Basic Principle  
- Applications

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**Media** LCD Projector  
Labcoat in Lab

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- Referensi**
1. Thermal Analysis, Koninklijke Philips Electronics N.V., 2008
  2. D.A. Skoog, F.J. Holler and S.R. Crouch: Principles of Instrumental Analysis, Thomson Brooks/Cole, Belmont, CA, 2007
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**Aktivitas**      Lecture  
                         Lab Demo

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## Minggu 13

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**Materi**            Particle Size Analyzer  
                         - Basic theory  
                         - Particle properties  
                         - Methods:  
                         Sieving  
                         Sedimentation  
                         Electrozone sensing  
                         Microscopy  
                         Laser diffraction

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**Media**            LCD Projector

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**Referensi**        1. R. Lambourne and T.A. Strivens: Paint and Surface coatings ? Theory and Practice; Woodhead Publishing Ltd., Cambridge, 1999  
                         2. M. Rhodes: Introduction to Particle Technology, 2nd Ed., John Wiley & Sons Ltd., West Sussex, 2008  
                         3. R.B. Gupta and U.B. Kompella: Nanoparticle Technology for Drug Delivery, Taylor & Francis Group, LLC., New York, 2006

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**Aktivitas**        Lecture  
                         Lab Demo/SEM

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## Minggu 14

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**Materi**            Transmission Electron Microscope  
                         - Introduction  
                         - Basic Theory  
                         - Basic Metallography  
                         - Sample Preparation  
                         - Basic Mechanism in Selected Area Diffraction

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**Media**            LCD Projector

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**Referensi**        1. C. Hammond: The Basics of Crystallography and Diffraction, 3rd Ed., Oxford University Press, 2009.  
                         2. B. D. Cullity: Elements of X-ray Diffraction, Addison-Wesley Publishing Company, Inc., 1978.  
                         3. R.J. D. Tilley: Crystals and Crystal Structures, John Wiley & Sons Ltd., 2006

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**Aktivitas**      Lecture

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## Minggu 15

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**Materi**            Question and Answering Session  
                      - Brief topic in one semester  
                      - Exercise and solution model

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**Media**            LCD Projector

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**Referensi**

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**Aktivitas**      Discussion

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## Minggu 16

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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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