MS4640 – Advanced Analysis of Materials

Course Code	MS4640					
Course Title	Advanced Analysis of Materials					
Pre-requisites	NIL					
Pre-requisite for	NIL					
No of AUs	3					
Contact Hours	Lectures	26	Tutorials	13		

Course Aims

This course will equip you with the analytical tools and methods needed to conduct nanometric assessments of inorganic materials at the atomic scale. This course is designed to prepare you for the solution of real-world problems in industry or to support postgraduate studies that will rely heavily upon advanced X-ray and electron beam methods for nanomaterials characterization. This course will further help you understand the operation procedures of various X-ray diffractometers and electron microscopes with the sufficient theoretical knowledge.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. Identify the capabilities and limitations of each of the crystal structure analysis techniques covered in the syllabus.
2. Select the appropriate technique for an investigative work.
3. Perform data analysis and interpretation of results obtained from XRD and TEM.
4. Successfully apply the characterisation techniques leaned to the final year projects.

Course Content

This course focuses on the advanced crystal structure analysis techniques, with emphasis on the following topics:

1. Basics of Crystallography
2. Advanced X-ray Diffraction techniques
3. Advanced Transmission Electron Microscopy
4. Integration of results for nanomaterials analysis

Reading and References

Textbooks/References

1. Elton N. Kaufmann (Editor), Characterization of Materials, John Wiley & Sons, 2003.
2. P.J.Goodhew and F.J.Humphreys, Electron Microscopy and Analysis, Taylor & Francis, second edition, 1992.
3. J.I. Goldstein, D.E. Newbury, P. Echlin, D.C. Joy, C. Fiori and E. Lifshin, Scanning Electron Microscopy and X-Ray Microanalysis, New York: Kluwer Academic/Plenum Publishers, 2003.
4. I.A.Watt, The principles and practice of electron microscopy, Cambridge, 1989.
5. M.H.Loretto, Electron beam analysis of materials, Chapman & Hall, 1988.
6. R. Wiesendanger, Scanning Probe Microscopy, Berlin; New York: Springer-Verlag, 1998.

Recommended reading

1. B. D. Cullity and S. R. Stock, Elements of X-Ray Diffraction, 3rd Edition, 2001, Prentice-Hall, Inc.
2. David B. Williams and C. B. Carter, Transmission Electron Microscopy – A Textbook for Materials Science, 1996, Plenum Press, New York.
3. "X-ray diffraction, Rietveld crystal structure refinement and high-resolution transmission electron microscopy of nano-structured materials", Handbook of Nanoceramics and Their Based Nanodevices, Vol. 3, p 303-336. American Scientific Publishers 2009, ISBN: 1-58883-117-5.

Course Policies and Student Responsibilities

(1) CA

Absentees must be supported by a medical certificate or other valid official documents.

Academic Integrity

Good academic work depends on honesty and ethical behavior. Quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honor Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student of NTU, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at the University. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, and collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.