
COURSE: ADVANCED ANALYTICAL CHEMISTRY (MOD. A + MOD. B)

ACADEMIC YEAR: 2016-2017

TYPE OF EDUCATIONAL ACTIVITY: Basic

TEACHER: Prof. Anna Maria Salvi

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 Language: **Italian (English for bibliographic research)**

 ECTS: **10 (5 + 5)**
(6 lessons + 4
 tutorials/practice

 n. of hours: **48 + 48**
(48 lessons + 48
 tutorials/practice)

 Campus: Potenza
 Dept./School: **Science Dept**
 Program: **Chemical Science (LM54)**

 Semester: **I**
06/10/2016-
31/01/2017

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course deepens the study of the electronic structure of solids with reference to surface and interface properties.

The aim is that of providing a complete picture of the various kinds of interaction between radiation/particles and matter at the basis of the examined instrumentations and of the various kinds of their output signals.

The performances of many spectroscopic and microscopic surface-specific techniques are compared within the applicative field of analytical chemistry with particular regards to data processing, elaboration and the results significance..

PRE-REQUIREMENTS

SYLLABUS

Natural and synthetic materials: classification on the basis of chemical bonds. Composite materials. Electronic structure of surfaces and interfaces. Collective electronic and vibrational properties in solids: plasmons, phonons. Adsorption and surface reconstruction. Study of the properties of surfaces and interfaces for the understanding of phenomena such as conductivity, adhesion, adsorption, corrosion, catalysis, etc.

General classification of the main surface- and interface techniques on the basis of the type of radiation' interaction with matter, of the information (structural, morphological, composition) and resolution, sensitivity and detection limits achievable. Demonstrative experience of the available and operational instrumentation will be provided. Illustrations of the specificity of the various instrumental techniques: sources, vacuum systems and/ or ultra-high vacuum (UHV) systems for the analysis and detection of the signal.

Electronic surface techniques available in the Department and their use for applications in Analytical Chemistry: Basic Principles of X-ray Photoelectron Spectroscopy (XPS or ESCA) for compositional analysis. Software for data acquisition and data processing. Curve-fitting procedure for the identification and quantification of the spectral peaks. Basic principles and operational modality of SEM (Scanning Electron Microscopy), AFM (Atomic Force Microscopy) and TEM (Transmission Electron Microscopy) techniques for morphological and structural comparison analysis.

Analyses of real samples by XPS and combined techniques. Planning of an optimal analytical scheme. Comparison and rationalization of the analytical significance of the results obtained.

Introduction to the chemometric analysis.

The final part of the course will be devoted to the elaboration of the experiments in form of technical report comprehensive of bibliographic research, to be discussed at the exam..

TEACHING METHODS

 Lectures / laboratory exercises / experimental report.

EVALUATION METHODS

Partial tests on experimental data processing useful for the preparation of the final report.

Oral examination

 Evaluation: score rating on 30 points

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

1. -D.Briggs, M.P.Seah 'Practical Surface Analysis' Vol. I e II. J.Wiley & Sons (1990).
 - 2.-P.A. Cox 'The Electronic Structure and Chemistry of Solids' Oxford Science Publications
 - 3.-P.E.Flewitt and R.K.Wild 'Physical Methods for Materials Characterisation' Institute of Physics Publishing– Bristol & Philadelphia
 - 4.-Dispense del Corso.
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5. <http://www.nist.gov/ts/msd/srd/surface.cfm> (XPS database)

INTERACTION WITH STUDENTS

The lectures will be followed by practical exercises to be held in the XPS laboratory and demonstration experiments with other equipment operating in the Department. As reported in Syllabus, the course aims to provide the foundation for learning the use of advanced instrumentations and the interpretation of data from these obtainable. Each student is assigned an individual application consisting on the analytical characterization, using XPS and any combined techniques, of a real sample, to be produced in form of experimental report.

Students will be constantly guided during practice and lesson times. In addition, they may encounter the professor for any didactic requirement every Tuesday and Thursday 16-17 hours (Study 4th floor Building MR-2DA) or other times to be agreed by e-mail: anna.salvi@unibas.it or by phone (3204238516).

EXAMINATION SESSIONS (FORECAST)¹

10/02/2017; 10/03/2017; 26/05/2017; 23/06/2017; 21/07/2017; 20/10/2017; 15/12/2017.

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

EXAMINATION PANEL

President: Anna Maria Salvi;

Member: Rosanna Ciriello

Member: Giuliana Bianco; **Member:** Antonio Guerrieri; **Member:** Giuseppe I. Casella

¹ Subject to possible changes: check the web site of the Teacher or the Department/School for updates.