UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	CHEMISTRY
SUBJECT	MATERIALS PREPARATION AND CHARACTERISATION
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20975-Attività formative affini o integrative
CODE	16494
SCIENTIFIC SECTOR(S)	CHIM/02
HEAD PROFESSOR(S)	SALADINO MARIA LUISA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	81
COURSE ACTIVITY (Hrs)	69
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**SALADINO MARIA LUISA** Monday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I Wednesday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I Thursday 14:00 16:00 Dipartimento STEBICEF, Edificio 17, piano I

DOCENTE: Prof.ssa MARIA LUISA SALADINO

PREREQUISITES	The preliminary knowledges are: stoichiometry, compound reactivity, radiation-matter interaction.
LEARNING OUTCOMES	Knowledge and ability to understand the main methodologies of synthesis of materials and in particular of nanomaterials and the principles of the spectroscopic, morphological and structural characterization techniques. Ability to apply knowledge and understanding; Students must develop skills related to the synthesis and preparation of nanostructured materials and composites for the recognition of essential properties and specific microscopic interactions that allow to interpret and predict the macroscopic behavior of physical systems. Judgment autonomy: To be able to: Identify the effect of experimental preparation parameters on material properties. Evaluate autonomously the application difficulties and the benefits of using the methdologies of synthesis and characterisation. Demonstrate the ability to integrate knowledge and manage complexity, and make judgments based on limited and incomplete information, integrating them by using scientific literature and designing additional experimental investigations. Communicative Skills: Be able to expose the basic concepts related to the expression of properties of materials and physical principles that regulate analytical techniques. Ability to comunicate clearly and without ambiguity, even to non-experienced interlocutors, their own conclusions and knowledge. Learning Skills: Be able to deepen the topics through specific scientific articles in an autonomous and individual way and to attend seminars and insights in the field of materials chemistry.
ASSESSMENT METHODS	Learning is evaluated by laboratory reports and an individual interview. Individual reports about the laboratory experiences should be articulated in a predefined scheme that includes an abstract, a description of the state of the art, a description of the materials, techniques and experimental procedures, a presentation and discussion of the results and conclusions. This method of drafting is aimed at verifying the ability of organization and of synthesis, and the ability to apply the theoretical concepts to a specific problem. Each report's rating is expressed in 30/30. During the oral interview, the student will have to answer at least three questions posed orally concerning the topics listed in the program, demonstrating that he has adequate knowledge and interpretative competence of the general and specific content, a capacity for linking and processing the contents, and a pertinent, ability to form cogent argumentation. The evaluation is expressed as 30/30 and is considered inadequate if the student has difficult to focus the proposed arguments, lack of knowledge and extreme limitation in exposure. The threshold of sufficiency (18/30) is achieved if the student's abilities allows the examiner to ascertain Knowledge and understanding of the topics at least in their general lines. The positivity of the assessment increases proportionally Increasing the degree of detail of the knowledge. The maximum score is obtained in case of excellent critical-interpretative competence of the contents of the course, associated with the ability to use of appropriate scientific terminology. The overall rating will be determined by the arithmetic mean of the marks obtained in the lab reports and the oral interview.
EDUCATIONAL OBJECTIVES	The course intends to explore some issues related to the nanostructured materials. In detail, some of the main methods of synthesis of nanostructured materials are deepened. The chemical-physical concepts related to the structural and spectroscopic properties of such materials are presented. In addition, the physical principles and methodologies of application of some spectroscopic, structural and morphological techniques are introduced. The laboratory activities are trying to tackle experimental issues related to the synthesis of nanostructured materials and to their structural, morphological and spectroscopic characterization.
TEACHING METHODS	lectures, laboratory's activity. The laboratory's activity will start after 2 weeks of lectures. In the framework of the laboratory, the brainstorning activity will be applied.
SUGGESTED BIBLIOGRAPHY	J.N. Lalena, D.A. Cleary, E. E. Carpenter, N.F. Dean, Inorganic Materials Synthesis and Fabrication, Wiley-Interscience, 2008. ISBN: 978-0-471-74004-9. Kenneth J. Klabunde, Ryan M. Richards, Nanoscale Materials in Chemistry, Second Edition, Wiley-Interscience, 2009. DOI:10.1002/9780470523674 Spectroscopy for Materials Characterization. Editor Simonpietro Agnello. Wiley. 2021. ISBN: 978-1-119-69732-9 R. Tantra, Nanomaterial characterisation. An Introduction, 2016 John Wiley & Sons, Inc.DOI:10.1002/9781118753460. Skoog, Leary, Chimica Analitica Strumentale, EdiSES, Napoli, 2009. ISBN 9788879593427. Articoli scientifici indicati dal docente.

SYLLABUS

Hrs	Frontal teaching
1	Presentation of the course, of the exam and of the drafting of the laboratory report.
1	Nanostructured Materials, Nanoparticles. Structure-property correlation.
3	Methodology of synthesis of nanoparticles. Bottom-up and Top-down methods. coprecipitation and sol-gel Method.
4	Synthesis in confined environment. Microwave assisted synthesis. Solvothermal methods in autoclave.
4	Mesoporous silica. Luminescent materials. Composites and dispersions.
1	Characterisation of nanostructured materials
1	Infrared Spectroscopy in ATR e TR
1	X-ray Fluorescence
1	Solid State NMR.
2	Use of neutrons for the characterisation of nanostructured materials
3	Scanning and Trasmission Electron Microscopy
2	Luminescence Spectroscopy.

Hrs	Workshops
1	Rules in laboratory. Description of laboratory activities.
4	Synthesis of nanopowders doped with rare earths by coprecipitation
4	Synthesis of mesoporous silica in confined environments
4	Preparation of nanocomposites.
6	Characterisation of nanoparticles by X-ray Diffraction.
4	Characterisation of materials by Attenuated Infrared Spectroscopy (ATR) and in Total reflection (TR)
4	Characterisation of nanoparticles by XRF
4	Characterisation of mesoporous silica by solid state NMR
4	Analysis of SEM and TEM micrographs.
4	Characterisation of materials by Luminescence Spectroscopy.
6	Software for data treatment. Discussion about the obtained data and data analysis. Writing the report of laboratory.