



## Sustainable Materials for Environment and Constructions

A.A. 2020/2021

Denominazione insegnamento	Sustainable Materials for Environment and Constructions	
Codice insegnamento		
Corso di Studio (CdS)	ENVIRONMENTAL AND TERRITORIAL SAFETY ENGINEERING	
Livello CdS		
Codice CdS		
Settore Scientifico Disciplinare (SSD)	ING-IND/22, Scienza e Tecnologia dei Materiali	
Crediti Formativi Universitari (CFU)	6	
Tipologia Attività Formativa (TAF)		
Tipo attività formativa		
Anno di corso		
Periodo didattico		
Docente responsabile	Luigi Pasqua. Associate Professor. Student assistance: Tuesday 2.30pm (booking by e-mail)	
Altri docenti coinvolti		
Organizzazione didattica*	<i>Ore Lezioni</i>	36
	<i>Ore Esercitazioni</i>	12
	<i>Ore Laboratorio</i>	
	<i>Ore Studio individuale</i>	
Lingua di insegnamento	English	
Propedeuticità		
Prerequisiti	Ability to recognize and categorize the different kind of materials and their main characteristics and properties. These issues will be summarized during the course.	
Contenuti	The course will present, with short summaries, recent advances in selected fields of materials science for sustainable applications in environmental and construction field.	
Obiettivi formativi (in termini di risultati di apprendimento attesi)	<p>The course aims to provide the student with an overview of today's potential in the field of sustainable materials for the environment and buildings</p> <p>To this aim, the characteristics of the main classes of materials will be summarized with reference to the nanostructure</p> <p>Aspects relating to the sustainable use of resources will be explored.</p> <p>The knowledge acquired upon completion of the course will be in line with the ability to solve the related problems with complete mastery. The experimental activity carried out in Laboratorio Didattico, in DIAM Department, will allow to strengthen the elements acquired during frontal lessons and acquire problem solving availability through the use of advanced technological level scientific instrument. Overall, critical and judgmental skills will be acquired such as to allow the development and management of a project possibly supported by experimental acquisition of supporting data, also organized in a report prepared for this purpose. The formative objectives include the ability to communicate the assessments made based on what has been learned and to integrate one's training in a completely autonomous way.</p> <p>An adequate analysis of the world of materials in their nanostructure and of the need for their sustainable use, and the active protection of the natural</p>	



	environment together with today's trend in the construction sector, will be carried out in detail during the course. This will initiate the student to the formation of a full autonomy of judgment that will allow him to apply the same approach to different problems.
<b>Programma</b>	<p>Overview on the traditional and advanced material classes structures and properties.</p> <p>Nanostructured materials: synthesis, structure/properties relationship.</p> <p>The transition towards sustainable materials: features for eco-friendly productions and recycle. General economic, social and environmental aspects of materials science and engineering. Sustainable materials for environment and constructions. Resource use and environmental impact of buildings. The re-use and sustainable qualifications of existing buildings. Composite materials, Aerial and hydraulic binders, concrete, wood, silicates and clays, glass, polymeric materials. General features nanostructure and applications. Construction and buildings alternatives: Wool bricks; Solar Tiles; Sustainable concrete; Paper insulation; Triple glazed windows; Straw bales; Bamboo; Acetylated Wood.</p> <p>Laboratory experiences:</p> <ol style="list-style-type: none"><li>1) Experimental determination of the glass transition, crystallization and melting temperature of a polymer through TG-DSC analysis</li><li>2) Experimental determination of the average molecular weight of a polymeric material through viscosity measurements;</li><li>2) Experimental comparison between traditional materials and modified materials according eco-friendly procedures aimed to improve performances.</li></ol>
<b>Modalità di erogazione</b>	Lessons and exercise experimental sessions.
<b>Metodologie didattiche</b>	<i>Traditional</i>
<b>Metodi e criteri di valutazione dell'apprendimento</b>	<p>Written proof and oral exam.</p> <p>Written examination, two hours long (open answer) is aimed to a preliminary evaluation of the expected learning outcomes both for the theoretical aspects than for the problem solving ability. Oral examination will serve to complete the assessment. The student, if necessary, will be, guided, in direction of the correct answer, with indications of progressively increasing importance, to evaluate the reasoning ability to formulate the final evaluation.</p>
<b>Testi di riferimento ed eventuali letture consigliate</b>	<p>Smith, Hashemi, Scienza e Tecnologia dei Materiali, Mc Graw Hill</p> <p>Manuale dei Materiali per l'Ingegneria, AIMAT, Mc Graw Hill</p> <p>Scienza e Tecnologia dei Materiali Polimerici, Bruckner, Allegra, Pegoraro, La Mantia, EdiSES</p> <p>Adsorption, Surface Area and Porosity, Greg, Sing, Academic Press.</p> <p>Update on Silica-Based Mesoporous Materials for Biomedical Applications, Luigi Pasqua, iSmithers UK</p> <p>Callister Rethwisch, Scienza ed Ingegneria dei Materiali, EdiSES</p> <p>Papers and Reviews from open literature provided from the lecturer in charge of the course.</p> <p>Lecturer's notes.</p>
<b>Peer review</b>	<i>(Indicare i docenti con i quali ci si confronta su tracce, modalità di esame e impegno studente)</i>
<b>Orario delle lezioni</b>	<a href="http://diam.unical.it">http://diam.unical.it</a>
<b>Calendario degli esami</b>	<a href="http://diam.unical.it">http://diam.unical.it</a>
<b>Commissione d'esame</b>	<a href="http://diam.unical.it">http://diam.unical.it</a>



STIMA DEL CARICO DI LAVORO PER LO STUDENTE				
	Lessons [Ore]	Exercises [Ore]	Laboratory [Ore]	Individual Preparation [Ore]
<b>Description argument block 1.</b>  Overview on the traditional and advanced material classes structures and properties.	10			22
Bibliografia e testiblocco argomenti 1 [fornire un'indicazione quantitativa del materiale]				
<b>Description argument block 2</b>  Nanostructured materials: synthesis, structure/properties relationship.	6			12
Bibliografia e testiblocco argomenti 2 [fornire un'indicazione quantitativa del materiale]				
<b>Description argument block 3</b>  The transition towards sustainable materials: features for eco-friendly productions and recycle. General economic, social and environmental aspects of materials science and engineering. Sustainable materials for environment and constructions. Resource use and environmental impact of buildings. The re-use and sustainable qualifications of existing buildings. Composite materials, Aerial and hydraulic binders, concrete, wood, silicates and clays, glass, polymeric materials. General features nanostructure and applications. Construction and buildings alternatives: Wool bricks; Solar Tiles; Sustainable concrete; Paper insulation; Triple glazed windows; Straw bales; Bamboo; Acetylated Wood.	18	3		50
Bibliografia e testiblocco argomenti 3 [fornire un'indicazione quantitativa del materiale]				
<b>Description argument block 4</b>  Laboratory experiences:  1) Experimental determination of the glass transition, crystallization and melting temperature of a polymer		9		10



through TG-DSC analysis				
2) Experimental determination of the average molecular weight of a polymeric material through viscosity measurements;				
3) Experimental comparison between traditional materials and modified materials according eco-friendly procedures aimed to improve performances.				
<b>Transversal Skills</b>	2			2
<b>Homework</b>				
<b>Exam preparation (further hours)</b>				6
<b>TOTALE</b>	<b>36</b>	<b>12</b>		<b>102</b>
<b>Complexive Hours</b>	✓ <b>150</b>			