UNIVERSITÀ DI TRENTO

Università degli Studi di Trento

Corso di Studio	0345H - Materials Engineering
Insegnamento	146299 - Laboratory of sustainable materials processing and characterization
Anno Offerta	2024/2025
Responsabile	DIRÈ SANDRA
Periodo	First semester
Modalità didattica	Convenzionale
Lingua	eng

ATTIVITÀ FORMATIVA DI RIFERIMENTO

Corso di Studio	0345H - Materials Engineering
Insegnamento	146299 - Laboratory of sustainable materials processing and characterization
Titolare	-

CAMPI

CONTENUTI/PROGRAMMA DEL CORSO

The course is aimed at improving and training the students' experimental skills through laboratory practice and modeling activities.

The main objective is to stimulate an active approach to selected scientific and technical topics.

The course will also be a useful opportunity to improve teamwork skills.

Materials will be produced using sustainable approaches (use of raw materials and by-products, low T synthesis, low-impact sintering technologies, functionalization under green conditions,..).

Produced samples will be subjected to structural, chemical-physical, mechanical, thermal, electro-optical characterization using various instrumental techniques (XRD, SEM, FTIR, NMR, ICP-OES, DR-UVVis, TGA/DTA/DIL, pycnometry and porosimetry, mechanical tests), depending on the problems to be solved in the laboratory activity.

Typical topics of laboratory activities are:

- Processing of ceramic components through powder shaping and sintering technologies
- Wet chemical synthesis of ceramic powders
- Analysis of the main microstructural features of a sintered artifact
- Modelling the sintering process and grain growth through theoretical approaches
- Ceramography of sintered artifacts
- Mechanical testing of sintered artifacts and their relation with the sintering schedule
- Surface functionalization of ceramic powders
- Qualitative and quantitative structural analysis and elucidation of structure-properties relationships of ceramic, glass and hybrid organic/inorganic samples
- Thermal characterization of ceramic powders
- Measurement of ceramic powder size and theoretical density

LIBRI DI TESTO/LIBRI CONSIGLIATI

For each lab activity, scientific and technical articles, and part of books related to the issues to be investigated will be suggested by the teacher; in addition, students will be asked to do literature research to find other relevant references.

OBIETTIVI FORMATIVI E RISULTATI DI APPRENDIMENTO ATTESI

The course aims at improving and train students' experimental skills through laboratory practice and activities to process experimental results. The objective is to stimulate an active approach to selected scientific and technical issues and improve teamwork skills.

After the course the students will be able:

- To apply the scientific method, i.e. to critically analyze the scientific/technical problem proposed and to find suitable solutions
- To analyze the state of the art through critical reading of the literature
- To manufacture ceramic components and nanomaterials
- To tailor materials properties through the sintering process and model the microstructural evolution of ceramics during the sintering process (surface area removal, densification, grain growth)
- To select and use suitably the available analytical techniques, such as ceramography, optical and scanning electron microscopy, thermal analyses (DTA, TGA, DSC and dilatometry) density measurements by Archimedes’ method and gas pycnometry, N2 physisorption analysis, biaxial bending tests, atomic emission spectroscopy, infrared and optical spectroscopy, X-ray diffraction, nuclear magnetic resonance, scanning electron microscopy, etc.
- To set up experiments; collect/present/analyze/discuss experimental results; calculate confidence levels; compare and correlate experimental data obtained by different techniques.
- To collaborate with other students through teamwork
- To use proper oral and/or written scientific communication for results dissemination.
- To answer questions made by an external audience.

PREREQUISITI

In order to successfully approach the course, the student shall be very confident from the beginning with the concepts learned from the first-year Master's courses, namely Ceramic Materials Engineering,

Physical Properties of Materials and Engineering Properties of Materials.

In details, students should be very familiar with topics related to structure of matter, ceramurgy, structural and microstructural characterization techniques, statistical analysis of experimental data.

METODI DIDATTICI UTILIZZATI E ATTIVITÀ DI APPRENDIMENTO RICHIESTE ALLO STUDENTE

Laboratory activity, including a short introduction to the different production methods, characterization techniques, and theoretical approaches to model the microstructural evolution of ceramics during sintering (densification and grain growth).

Students will be asked to design an investigation protocol in order to obtain a full characterization and possibly highlight the structure - properties relations. After discussion with the teachers and lab assistants, guidelines for setting up experiments and analyzing experimental data will be provided.

Students will perform the experiments, analyze and discuss the experimental data, and summarize the final results by working in groups (possibly no more than 3 students per group), with the assistance of the teacher and lab assistants.

Periodic meetings will be scheduled to train students in good practice in results presentation: the students of each group will review the performed activity through a short PP presentation to the teachers and the students of other groups of the same course.

ALTRE INFORMAZIONI

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METODI DI ACCERTAMENTO E CRITERI DI VALUTAZIONE

The examination consists of a final oral presentation given by the groups of students involved in the same activity. Students must clearly present and discuss the experimental results obtained during the laboratory activity using a PowerPoint presentation.

Each student in the group will be awarded an examination grade based on the quality of her/his presentation and the ability to answer questions asked by the committee.

DOCENTI ASSOCIATI

BIESUZ MATTIA
NESSUN DOCENTE
NESSUN DOCENTE