

**Course offered by the PhD program
in Civil, Chemical and Environmental Engineering
a.y. 2026/2027 (42 cycle)**

(course is open for participation of students from other PhD cycles or programs)

1. Title

Characterization of powdered materials.

2. Course Objectives and Description

The course aims to provide to future PhDs notions and fundamentals on relevant techniques for material characterization. The course will include the following topics:

1. Elemental composition: atomic absorption and emission spectroscopies, X-ray fluorescence and Energy-dispersive X-ray (EDX) analysis.

2. Structural properties of inorganic materials and their characterization: X-Ray diffraction, vibrational and UV-vis spectroscopies.

3. Morphology characterization: Surface area and porosity and scanning electron microscopy (SEM).

4. Analysis of the surface structure and composition: X-ray photoelectron spectroscopy (XPS), surface acidity and basicity characterization using probe molecules and studies of the surface redox behavior.

5. Laboratory training: analysis of one sample of PhD student interest through vibrational spectroscopies at catalysis laboratories.

3. Course Organization

The course, organized into a single module, will consist of classroom lessons and practical laboratory training. The course will be held in English.

4. Teacher

The course teacher will be Prof. G. Garbarino (9 h) and Ing. Elena Spennati (6 h)

5. Duration and credits

The course (15 hours) will consist of 5 lessons, 3 hours each, including a 2-hour tutorial in the laboratory, for a total of 3 credits.

6. Activation mode and teaching period

The course will be held from July to September 2027, and registered students will receive a detailed calendar of lessons.

7. Deadline for registration

Registration for the course must be made before March 15th, 2026. Students are requested to inform teachers by e-mail (gabriella.garbarino@unige.it, elena.spennati@unige.it) about their registration.

8. Final exam

The final exam will consist of an oral discussion on the topics covered by the course. The students are requested to email the teacher to establish the date of the exam.