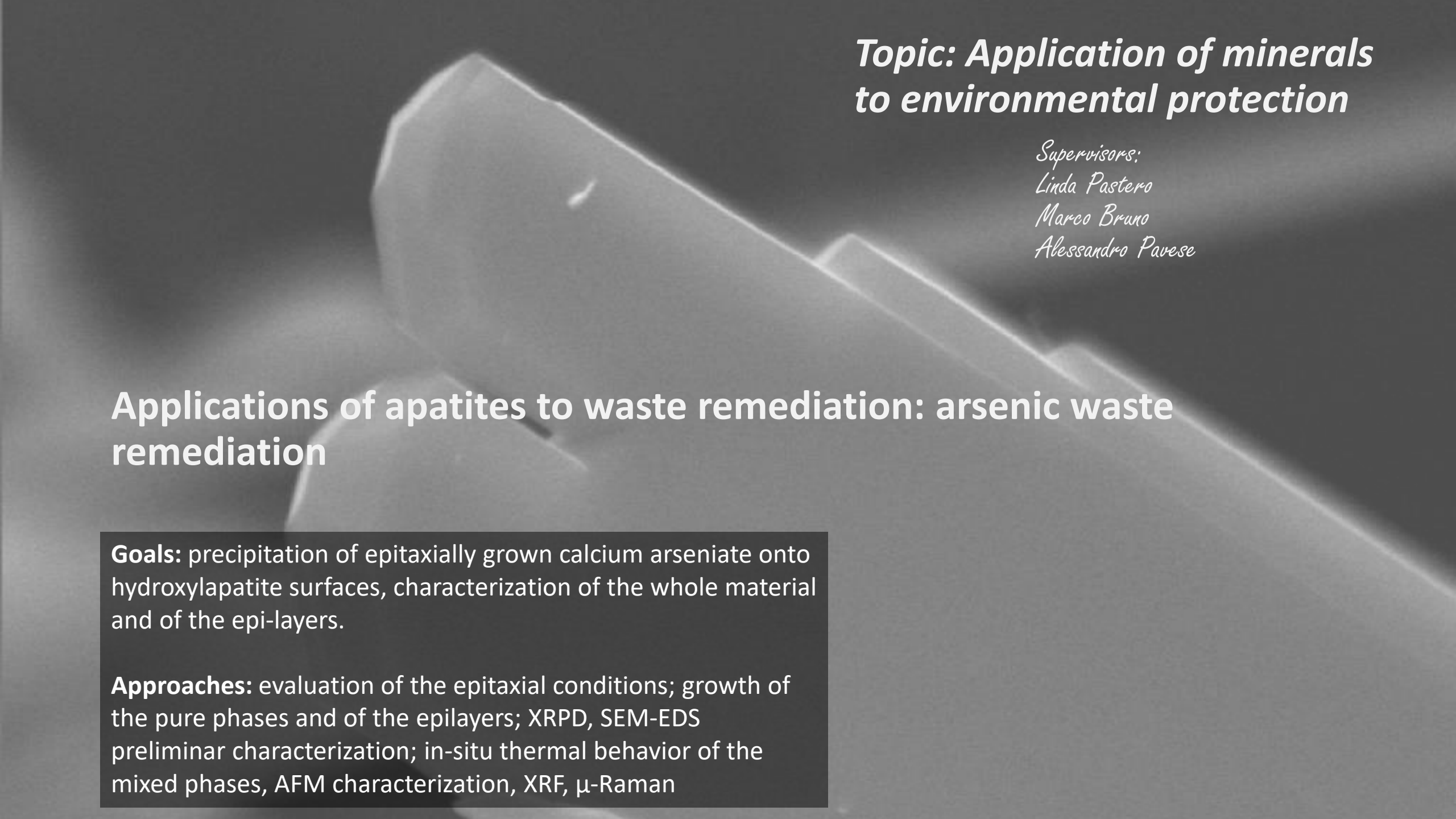


Tailored synthetic and natural functional materials

The group's activities are devoted to comprehend the minerals growth mechanisms, their characterization and modeling. The applications of minerals range from their natural behavior, to their use in the environmental, medical and technological fields. In particular, some minerals like phosphates and carbonates find their application in environmental remediation through epitaxial growth processes, exploitable to reduce pollution definitively (within the mineral's stability field). Moreover, phosphates, oxalates and carbonates play a pivotal role in biological and pathological mineralization. The methodological approach usually starts from a reliable hypothesis of application that should be verified from the theoretical point of view. The attention will then move towards the crystalline phases' growth in a pure environment and in the presence of the impurity that should be immobilized. Finally, the mineral will be grown in an actual simulated environment, taking into account the chemical and physical variables representing the application's real conditions. To allow these activities, a portfolio of experimental techniques will be made available, starting from the crystal growth facilities (*reactors for the crystal growth from solution at room temperature and pressure, at mild hydrothermal conditions, at HT/HP conditions, reactors for crystal growth in reduced gravity*) to the characterization techniques (*Optical microscopy, XRPD, Single Crystal diffraction, TEM, SEM-EDS, FESEM, AFM, μ -Raman, XRF*) and modeling.

MOST ACTIVITIES ARE CARRIED OUT IN
COLLABORATION WITH INDUSTRIAL PARTNERS:
IREN - TRM
ECOSPRAY TECHNOLOGIES

linda.pastero@unito.it



Topic: Application of minerals to environmental protection

*Supervisors:
Linda Pastero
Marco Bruno
Alessandro Pavese*

Applications of apatites to waste remediation: arsenic waste remediation

Goals: precipitation of epitaxially grown calcium arseniate onto hydroxylapatite surfaces, characterization of the whole material and of the epi-layers.

Approaches: evaluation of the epitaxial conditions; growth of the pure phases and of the epilayers; XRPD, SEM-EDS preliminar characterization; in-situ thermal behavior of the mixed phases, AFM characterization, XRF, μ -Raman

A scanning electron micrograph (SEM) showing several mineral crystals. In the center is a large, rectangular, plate-like crystal. To its left and below are two smaller, more rounded, shell-like crystals with concentric growth rings. Another similar rounded crystal is visible in the bottom right corner. The background is dark and out of focus.

Topic: Application of minerals to environmental protection

Supervisors:

Linda Pastero

Alessandro Pavese

Marco Bruno

Applications of carbonates and oxalates to carbon dioxide reduction and heavy metal mitigation in waste water

Goals: precipitation of carbonates and oxalates for carbon capture purposes, characterization of the materials, hypothesis on the growth mechanisms and their dependence on measurable parameters

Approaches: growth of crystalline phases from pure CO₂/mixed gas containing CO₂ in variable amount, XRPD, SEM-EDS characterization; in-situ thermal behavior of the oxalates



Topic: Application of minerals to environmental protection

*Supervisors:
Linda Pastoro
Alessandro Pavese
Marco Bruno*

Applications of carbonates / phosphates / oxalates to heavy metal waste remediation

Goals: heavy metal trapping by carbonates, oxalates and apatites; growth of nearly insoluble metal phosphates both as single phases and epilayers; metal selection by oxalates and phosphates

Approaches: growth of crystalline phases from solution at RT/RP conditions, XRPD, SEM-EDS characterization; in-situ thermal behavior of the crystalline phases, XRF, μ -Raman

Topic: Minerals and health

Supervisors:

Linda Pastero

Marco Bruno

Alessandro Pavese

Molar Incisor Hypomineralisation (MIH) disease: apatite/drug interactions during crystal genesis

Goals: a model of growth of pathologically mineralized apatites in the presence of specific drugs

Approaches: growth of apatite from solution at physiological conditions, XRPD, SEM-EDS, FESEM, TEM, μ -Raman characterization; in-situ thermal behavior of the crystalline phases