

PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 41st cycle

Research Area n. 3 - Environmental and Hydraulic Engineering and Geomatics

INTERDISCIPLINARY Research Field: DYNAMICS OF MINERAL-WATER INTERFACES DRIVEN BY DISSOLVED HEAVY METALS

Monthly net inco	me of PhDscholarship (max 36 months)
1400.0	
In case of a change of the welfare rates during the	three-year period, the amount could be modified.
Context of the research activity	
Motivation and objectives of the research in this field	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "MATHEMATICAL MODELS AND METHODS IN ENGINEERING". See https://www.dottorato.polimi.it/?id=422&L=1 for further information.
Methods and techniques that will be developed and used to carry out the research	The key scientific objective of the project is to develop theoretical and computational advancements along with operational tools to characterize the heterogeneity of reaction patterns in a stochastic context across diverse support/resolution scales and Fields of View on mineral surfaces. A crucial cornerstone is recognizing that reaction rates at the mineral-water interface cannot be realistically treated in a deterministic context. During the project, (geo)statistically-based models will be developed to render the scaling features of sample probability distributions and related statistical moments. Characterizing descriptive statistics of observables (based on available and planned laboratory experiments) allows for quantifying uncertainty at given scales. An original multi-scale (physics-informed) geostatistical modeling



	framework is planned for development. Advanced numerical methods will be studied to efficiently solve coupled PDEs for mass transport, reactions, and mineral changes, balancing accuracy and computational efficiency.
Educational objectives	The project empowers the PhD candidate with: (i) enhanced understanding of nanoscale geochemical processes at fluid-mineral interfaces in environmental and industrially relevant contexts; (ii) strong methodological skills in theoretical analysis and computational modeling; (iii) the ability to collaborate effectively across disciplines and communicate with experts from diverse scientific backgrounds; and (iv) advanced competencies in framing complex research problems and developing robust, physics-based and data-driven solutions.
Job opportunities	Graduates based on this PhD project will be well-prepared for research and development roles in academia, governmental research institutions, and international environmental agencies. The advanced computational and modeling skills acquired are highly valued in industries addressing subsurface contamination, energy storage, and carbon sequestration. The strong emphasis on interdisciplinary expertise in geochemistry, nanoscience, and numerical simulation can also open career opportunities in consulting firms focused on environmental risk assessment and subsurface resource assessment and management.
Composition of the research group	3 Full Professors 0 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Alberto Guadagnini, Paola Antonietti

Contacts

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POLITECNICO DI MILANO



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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	
Housing - Out-of-town residents	

Scholarship Increase for a period abroad		
Amount monthly	700.0 €	
By number of months	6	

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year The Ph.D. course supports the educational activities of its Ph.D. students with an additional funding equal to 10% of the scholarship, starting from the first year.

Teaching assistantship: availability of funding in recognition of support to teaching activities by the PhD student There are various forms of financial aid for activities of support to the teaching practice. The PhD is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: each Ph.D. candidate has their own computer for individual use.

Desk availability: each Ph.D. candidate has their own desk, cabinet and locker.