Master Thesis proposal 2023

Masterised MAP4D: Testing and validate real-time Multiphysics Mapping of Porous media and Damage processes due to salts ingress into building heritage materials

Building heritage remains are often directly exposed to their environment and in particular to water, agent or vector of damages: water can be a agent/cause of damage, by phase change in cyclic freezing conditions /thaw, or dissolution and erosion; water as a vector of alteration or damage, conveying dissolved salts responsible for the phenomenon of alteration during cycles of saturation/desaturation. These processes of crystallization/dissolution of salts are recognized as particularly devastating, which can lead to the ruin of materials and structures. Despite several investigations, there are no data in the literature combining capillarity phenomena in a porous environment of the heritage and direct observations of the processes of precipitation, dissolution of salts. We propose to study these phenomena through series of simple in situ controlled imbibition experiments at two scales. We will be particularly interested in the conditions of nucleation and growth of salt crystals on and in porous supports. The spatial and temporal distribution of the crystallized phases will be analyzed in relation to the saturation of the porous network and the concentration gradients of the wetting solutions. Two scales of investigation will be privileged. The characterization of porous networks will be done by capillary imbibition and drained porosimetry experiments on centimetric samples. Monitoring of capillary imbibition by saline solutions will be done at the pore scale under Raman microscopy. Maps of saturation, then nucleation and saline crystallizations can be established. These multi-parameter maps will thus enrich the databases of the scientific community interested in the processes of damage by salts to heritage materials.

- **Grant duration: 6 months.**
- **The position** can be filled by the successful candidate in **february-march 2023**.
- **4 Partners:** I-Mat CYU (LPPI, GEC, L2MGC Labs) and CICRP
- **1 external contributor:** METIS, CNRS-Sorbonne Université
- **Complete applications (CV + cover letter)** should be sent to :

  Dr Jérôme WASSERMANN (jerome.wassermann@cyu.fr) and Dr Sébastien PERALTA (sebastien.peralta@cyu.fr).
- For additional informations :
  - http://www.sciences-patrimoine.org/projet/map4d/
  - https://www.cyu.fr/federation-i-mat
  - https://cicrp.info