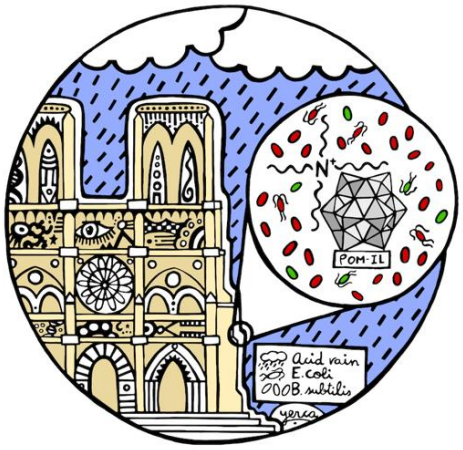
Polyoxometalate-Ionic Liquids (POM-ILs) as Anticorrosion and Antibacterial Coatings for Natural Stones

I. Franco-Castillo[1], A. Misra[2], E. Atrián-Blasco,[1] A. G. Enderle[2], J. M. de la Fuente[1], A. Koziróg[4], A. Otlewska[4], M. Piotrowska,[4] K. Rajkowska,[4] S. Eyssautier-Chuine[3], C. Streb[2] and S. G. Mitchell[1]

[1] *Instituto de Nanociencia de Materiales de Aragón (INMA), Consejo Superior de Investigaciones Científicas (CSIC)-Universidad de Zaragoza and CIBER-BBN*
[2] *Institute of Inorganic Chemistry I, Ulm University*
[3] *Université de Reims Champagne-Ardenne*
[4] *Institute of Fermentation Technology and Microbiology, Lodz University of Technology*

Microorganisms such as moulds, bacteria and algae constitute the main biodeterioration agents in cultural heritage objects. The biodeterioration of architectural heritage represents a recurring economic problem and can also affect the health of restorers and general public.[1,] The overall aim of our current research efforts is to engineer a range of molecular and hybrid nanomaterials with modular and tuneable properties antimicrobial properties, which act to help prevent the biodeterioration of cultural heritage objects.[2,3] In this work we present the development and application of polyoxometalate ionic liquids (POM-ILs) as antimicrobial and anticorrosive coatings for heritage conservation. We have demonstrated how the application of POM-ILs as colourless coatings can protect different types of natural stones from environmental corrosion and microbial colonization due to their hydrophobic, acid resistance and antimicrobial properties. Furthermore, their tuneable characteristics have allowed us to develop new promising broad-spectrum antimicrobials against a wide range of microorganisms, from non-pathogenic (*E. coli* DH5-α, *B. subtilis*) and pathogenic (VTEC, *L. monocytogenes*) bacteria, to environmental moulds (*A. niger*, *C. cladosporioides*, *E. album*, *C. cladosporioides*, *A. alternata* and *A. fumigatus*) and alimentary mycotoxin-producing (*A. ochraceus*, *P. expansum*), as well as *Chlorella* algae (*C. zofingiensis*).[4-6]



1. K. Sterflinger, *et al. Appl. Microbiol. Biotechnol*., **2013**, *97*, 22, 9637-9646.
2. I. Franco-Castillo, *et al. Chem*, **2021**, DOI: 10.1016/j.chempr.2021.01.006
3. I. Franco Castillo, *et al. J. Mater. Chem*. B, **2019**, *7*, 6412-6419.
4. A. Kubo, *et al. ChemPlusChem,* **2017**, *82*, 6, 867-871.
5. A. Misra, I. Franco-Castillo *et al. Angew. Chem. Int. Ed*., **2018**, *57*, 45, 14926-14931.
6. K. Rajkowska, *et al. Molecules*, **2020**, *25*, 23, 5663.