

Sustainable Materials for Metal and Built Heritage Conservation

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Cultural heritage is increasingly exposed to environmental degradation, with climate change further intensifying the effects of temperature and humidity fluctuations, atmospheric pollutants and extreme weather events. These factors accelerate the deterioration of metal and stone artefacts, threatening their aesthetic, chemical and structural integrity and, consequently, their long-term preservation.

In response to these challenges, our research focuses on the development of sustainable and multifunctional protective solutions based on bio-derived and renewable materials. Biopolymers such as chitosan and cellulose derivatives, combined with environmentally friendly functional additives, have been investigated to provide effective protection against degradation processes affecting metallic substrates, including bronze and silver, while reducing the environmental and health impacts associated with conventional treatments. Sustainable materials for the protection of steel rebars embedded in concrete matrices have also been explored, focusing on multifunctional and stimuli-responsive properties.

The developed formulations have been assessed through accelerated ageing and degradation tests, as well as natural ageing under real environmental conditions. Results demonstrate their potential to combine protective performance, durability and sustainability, supporting the transition towards safer and more environmentally responsible conservation practices for cultural heritage.