

Smart and eco-sustainable materials for the long-term and safe protection of concrete heritage within the ECOforCONCRETE project

### **Abstract**

The corrosion of steel rebars represents one of the main degradation causes in concrete heritage. It is well known that the formation of corrosion products can induce mechanical stress into the concrete structure and those are typically responsible for cracks formation, spalling and detachment of the surface cover. To preserve concrete monuments of artistic, cultural or social value, it is necessary to develop not invasive conservation treatments that are purposely designed for cultural heritage applications.

In the last decades, the search on new materials for the sustainable and long-term protection of steel rebars has received increasing interest. It is worth noting that new solutions should be safe for humans and the environment, preserving the surface appearance and ensuring protection from corrosion.

To face these issues, we have developed active protective materials based on stimuli responsive nanocarriers that can release a corrosion inhibitor only in a degrading environment. This approach was applied to the conservation of concrete monuments within the EU H2020 InnovaConcrete project (G.A. n. 760858). Different corrosion inhibitors for steel rebars were validated in simulated concrete pore solutions and the most promising ones were loaded into nanocarriers, as silica and layered double hydroxides, for a tailored release. Results showed that, by selecting an appropriate nanocarrier, it is possible to control the inhibitor release depending on external stimuli.

Efforts are now addressed to make these protective materials greener and to increase their protective efficacy. Safe and sustainable corrosion inhibitors have been selected and validated by comparing their protective properties with those of a benchmark. This activity is carried out within the “Smart and eco-sustainable materials for the long-term and safe protection of concrete heritage – ECOforCONCRETE” project (MUR PRIN2022 2022M4KCKP) which is kindly acknowledged for financial support.