Green coating and consolidants ease the restoration of historical objects

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Restoring cultural heritage objects is difficult enough, at the same time having to maintain their authenticity, but it becomes even more of a brainteaser when adding environmental concerns to the mix. New materials developed and tested under the HEROMAT project will help restorers to take on both challenges simultaneously.

HEROMAT (Protection of Cultural Heritage Objects with Multifunctional Advanced Materials) was a multidisciplinary research cooperation project that aimed to develop innovative and environment-friendly materials for the restoration of immovable Cultural Heritage assets in continental Europe. After four years of intensive research and tests conducted on two sites in Serbia and Slovenia, the consortium shortlisted three materials: two consolidants for carbonate and silicate substrates and a photocatalytic material for porous substrates.

The novel materials are applicable for the protection of different inorganic mineral substrates and provide added value in terms of consolidation, self-cleaning, anti-microbial effect and sustainability. Prof. Dr Jonjaua Ranogajec, coordinator of the project for the University of Novi Sad Faculty of Technology, discusses these outcomes and their market potential for different kinds of historical objects located across Europe, but also in modern building engineering.

How do HEROMAT solutions differ from other market offerings? What's their added value?

There are three final HEROMAT solutions: one photocatalytic coating and two consolidants, one for carbonate and the other for silicate-based substrates. Compared to products already available on the market, HEROMAT consolidants differ right from the very beginning of the research planning. Both consolidants were prepared so as to be compatible with historical objects stored under a continental climate. Therefore they have no harmful effects in the long run.

On the other hand, our photocatalytic coating is a totally new product to be placed on the market. It is also compatible with historical materials boasting added value as a self-cleaning coating based on anion clays.

All in all, the application of our newly-developed materials extends the period between two restoration procedures, the lifetime of cultural heritage assets (and other buildings), and therefore decreases investments in cleaning and protecting objects.

The project focused on two specific works of art. What were your main criteria for selecting them?

Both objects were already chosen at the stage of project planning to serve as case studies for two types of historical objects. One is a fortress in Bac, Serbia. It is located in an urban environment, dates back to the 14th century and is made of dominant materials such as brick, mortars and renders. The other object is the baroque castle manor in Dornava, Slovenia. There are dominant items made of sculptured stone and concrete placed in the open area of the castle gardens.

Such historic materials are used for the characterisation, design and testing of new materials. Both objects are subjected to the continental climate of central Europe, while some testing of the HEROMAT products is also performed on the Adriatic coast and in the northern

Russia region.

Are you happy with the results of your work on these artefacts?

HEROMAT contributed to effective, long-lasting solutions for the prevention of degradation of cultural assets while keeping their authenticity, functionality and aesthetic appearance and generating socio-economic benefits.

We produced a consolidant for carbonate substrates, a consolidant for silicate substrates, photocatalytic suspension for cultural heritage objects (brick, render, mortar and stone), a methodology for the assessment of adhesion characteristics of photocatalytic suspension on porous mineral substrates, and an assessment of the antifungal characteristics of porous mineral substrates. Besides this, we also produced dissemination reports, publications in scientific journals and a project website.

We are highly satisfied with these results. Our new products are environmentally-friendly and highly compatible with historical materials, promising reduced costs for the maintenance of immovable cultural heritage. The monitoring of our case study materials was performed in two cycles, right after application, and 12 months later, and the results are encouraging for future market placement.

What kind of materials did you eventually select and why?

Materials produced in the HEROMAT project are natural materials meeting the high requirements of historical materials forming the core of the case study objects—brick, clay, mortar, render, stone, concrete. From the beginning, two types of materials were planned: consolidants

and photocatalytic coating. They were developed, designed and produced step by step, following several phases of testing and compatibility assessments. All three materials are based on water and therefore are harmless to the environment.

How did you assess this environmental impact?

The detailed assessment was performed in different life stages of the project. One work package was devoted to studying the environmental footprint of the newly developed protective materials and to evaluating their environmental friendliness. The study was based on use of the 'Life cycle assessment' (LCA) technique. The existing LCA models for protective materials were identified, cradle-to-gate models were developed for each formulation and, finally, a multi-decisional tool for the selection of the best protection materials was designed.

The environmental footprints of the carbonate consolidant and photocatalytic suspension were found to be relatively low, and both products can be considered as environmentally-friendly with regards to energy consumption and greenhouse gas emissions.

What were your other criteria for selecting the best materials?

Comparing performance characteristics with health and safety data—which, according to our survey, are the two most important criteria for conservators and other stakeholders—a preliminary decision could be made as to which of the available materials were the most suitable for treatment of a given piece of cultural heritage.

Characteristics such as reversibility, minimum intervention and re-treatability are also indicated, as important and additional information

about the suitability of the materials should also be sought. Peer recommendations, application techniques, price and availability of the materials were also integrated in decision-support tools and can help conservators and stakeholders make a final decision. By using them, decision makers can compare different materials easily and, based on data shown in the supporting tables, choose the most adequate materials for the treatment of any given item of immovable cultural heritage.

Speaking of which, what kind of historical objects can be restored using your technology?

In addition to the two case study historical objects located in urban and rural environments with a continental climate, our products were applied on the Petrovaradin Fortress on the Danube in Novi Sad, Serbia and also for consolidation of frescos in St. Vincenta's Church, Istria, Croatia. HEROMAT's final products could be applied for the restoration and protection of a wide range of immovable cultural heritage in Europe, as well as in modern civil engineering where photocatalytic coating can greatly extend the lifetime and aesthetic appearance of colour layers of modern buildings—especially in highly polluted environments like cities with heavy traffic.

What are your commercial plans for your materials, if any?

The next steps consist in preparations for the launch of three final HEROMAT products on regional and European markets, especially in Italy, Germany and other countries in urgent need of advanced solutions. Moreover, our products are expected to enter the Russian market (one of the HEROMAT partners is NArFU University in Arkhangelsk, Russian Federation). Our products will be marketed to our network of conservators, and special attention will also be given to the placement of

photocatalytic coating in the modern building industry.

More information: For more information, see the project website: www.heromat.com/

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