

Nano-Cathedral

Nano-Cathedral
Nanomaterials for conservation of European architectural heritage developed by research on characteristic lithotypes

NANO-CATHEDRAL PROJECT

Cathedrals, distributed throughout Europe, are representative of the diversity of European cultural heritage. Few different cathedrals were selected as they may be considered as representative of both different exposure conditions and different types of stones. In particular, the Cathedral of Pisa, in central Italy, and the Cathedral de Santa María de Vitoria-Gotor in Spain were selected as representative of south European "Mediterranean" climate in coastal and continental regions, respectively; the Six-Teeth Cathedral of Ghent, in Belgium, the Cathedral of St. Peter and Mary in Cologne, Germany and the St. Stephen's Cathedral, in Wien, Austria, were selected as representative of North European "temperate" climate in regions respectively.

Moreover, the Oslo Opera House, was considered as an example of a contemporary building coated with white Carrara marble.

They also represent different lithotypes such as marble, sandstone, limestone.

The objective is providing "key tools" for restoration and conservation:

- On representative lithotypes
- On European representative climatic areas
- With a time-scale/environmental approach
- With technology validated in relevant environment (industrial plant and monuments)
- Exploring results also on modern stone made buildings

WHAT ARE THE INNOVATIONS?

The results of the project will provide both innovation in technology and rationalization of the conservation policy, attracting a renewed knowledge of the complex system "treatment/stone substrate", and of the durability threshold of these treatments.

Innovative materials, such as nano-particle based consolidants and proper polymer nanocomposites (sand coatings) will be developed, in agreement with the IMP-21 call requirements. In particular, the employment of nano-particle with different composition will allow to provide methods for consolidations, protection and pollutants decomposition, thus preventing part of the degradation and providing long-term conservation.

All environmental aspects related to the new materials will be included, to ensure development of sustainable and compatible materials and methods.

APPROACH

The multidisciplinary approach is granted by the presence of expertise covering the field of geology and materials science, institutions for management and preservations of the cathedrals, restoration companies and also nano-particles and coating producers.

The multidisciplinary approach is granted by the presence of expertise covering the field of geology and materials science, institutions for management and preservations of the cathedrals, restoration companies and also nano-particles and coating producers.

The production processes and technology of restoration will allow the development of affordable methodologies, granting reliability of the developed chain.

THE KIND OF SYNERGY IS NANO-CATHEDRAL'S KEY FOR INNOVATION.

THE SELECTED MONUMENTS

PISA	VITORIA	WIEN	KOLN	GHENT	OSLO
BUILDING PERIOD Medieval Age	BUILDING PERIOD Medieval Age	BUILDING PERIOD Medieval Age (1140-1513)	BUILDING PERIOD Medieval Age (1248-ca. 1520) 19th Century (1842 - 1880)	BUILDING PERIOD Medieval Age (942-1058) 14th-15th Centuries (1300-ca. 1500)	BUILDING PERIOD 2003-2007
ARCHITECTURAL STYLE Pisan Romanesque	ARCHITECTURAL STYLE 13th - 15th Centuries Gothic	ARCHITECTURAL STYLE Late Romanesque and Gothic	ARCHITECTURAL STYLE Gothic Neogothic	ARCHITECTURAL STYLE Renaissance Baroque Burgundian Gothic	ARCHITECTURAL STYLE Contemporary
MAIN LITHOTYPES CLASSES Mount Pisano marble /local limestone /Apuan marble /Proconnesian marble /Calcareous /granitoid rocks /serpentinite	MAIN LITHOTYPES CLASSES Lumachella from Ajete /sandstone from Egües /Calcareous from Ollarizu	MAIN LITHOTYPES CLASSES Limestones from Letha mountains and Vienna, few siliceous sandstones from Lower Austria	MAIN LITHOTYPES CLASSES Dolomitic Trachyte Schistose Sandstone / Obernkirchen Sandstone / Savonnières Limestone / Volcanic Tuffstones / Basalt Ivory	MAIN LITHOTYPES CLASSES Dolomitic Trachyte Schistose Sandstone / Obernkirchen Sandstone / Savonnières Limestone / Volcanic Tuffstones / Basalt Ivory	MAIN LITHOTYPES CLASSES White Carrara marble

AUTHORS

A. Lazzari¹, M.B. Caffellari¹, M. Gherardi², V. Cadei³, L. Tonello⁴, F. Gherardi⁵, D. Salmeri⁶, L. Festa⁷, I. Wichter⁸, M. Mazzatorta⁹, M. Cicali¹⁰, A. Rinaldi¹¹, M. Schäfer¹², R. Tassanelli¹³,
[1] National Inter-University Consortium of Materials Science and Technology (CNR-IMM), Italy
[2] Istituto Superiore per la Conservazione ed il Restauro (ISC), Italy
[3] Wacker Group S.p.A., Italy
[4] Institute of Arts and Technology/University of Applied Arts Vienna, Austria
[5] Forschungsbereich für Ingenieurgeologie, Institut für Geotechnik, Technische Universität Wien, Austria
[6] Karlsruhe Institute of Technology, Institute for Applied Sciences, Department of Microbiology, Germany
[7] Otto-Friedrich University Bamberg, Germany

EUROPEAN UNION
The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646570
NanotechITALY2015
RECALL, 11 AUGUST 2013

Logos of partners and sponsors: CNR-IMM, Istituto Superiore per la Conservazione ed il Restauro (ISC), Wacker Group S.p.A., Institute of Arts and Technology/University of Applied Arts Vienna, Austria, Forschungsbereich für Ingenieurgeologie, Institut für Geotechnik, Technische Universität Wien, Austria, Karlsruhe Institute of Technology, Institute for Applied Sciences, Department of Microbiology, Germany, Otto-Friedrich University Bamberg, Germany.