

Nano-Cathedral



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

Innovation for Europe
Cultural Heritage
Protection and
Conservation

NANO-CATHEDRAL PROJECT

Cathedrals, distributed throughout Europe, are representative of the diversity of European cultural heritage. Five 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 of Vitoria-Gasteiz in Spain were selected as representative of south European "Mediterranean" climate in coastal and continental regions, respectively; the Sint-Baas 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 climate in coastal and continental 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)
- Exploiting results also on modern stone made buildings

WHAT ARE THE INNOVATIONS?

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

Innovative materials, such as nano-particle based consolidants and proper polymer nano-composited based coatings will be developed in agreement with the IUPAC-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.

An environmental impact assessment of 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 preservation of the cathedrals, restoration companies and also nano-particles and coating producers.

The multidisciplinary approach and the inclusion of industrial partners directly involved in the production processes and technology of restoration will allow the development of affordable methodologies, granting reliability of the developed chain.

THIS 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. 1320) 19 th Century (1842 - 1880)	BUILDING PERIOD Medieval Age (942-1038) 14 th -16 th Centuries (1300-ca. 1568)	BUILDING PERIOD 2003-2007
ARCHITECTURAL STYLE Pisan Romanesque	ARCHITECTURAL STYLE 13 th -16 th Centuries Gothic	ARCHITECTURAL STYLE Late Romanesque and Gothic	ARCHITECTURAL STYLE Gothic Neogothic	ARCHITECTURAL STYLE Romanesque Brabantine Gothic	ARCHITECTURAL STYLE Contemporary
MAIN LITHOTYPES CLASSES Mount Pisano marble, Juncal limestone, Apuan marble (Proconnesian marble / calcarenite, granitoid rocks / serpentinite)	MAIN LITHOTYPES CLASSES Lumachella from Ajarte / sandstone from Egueta / calcarenite from Oleria	MAIN LITHOTYPES CLASSES Limestone from Löss mountains and Vienna, few siliceous sandstones from Lower Austria	MAIN LITHOTYPES CLASSES Grachensee Trachyte / Schalksdorf Sandstone / Coemkirchen Sandstone / Savonnières Limestone / Volcanic Tuffstones / Basalt lava	MAIN LITHOTYPES CLASSES Grachensee Trachyte / Arenaceous limestone belonging to the Leids Formation (Belgium), and Belgian and French limestones as replacement materials (from Gooberange, Evuille, Savonnières and Messange)	MAIN LITHOTYPES CLASSES White Carrara marble

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