

Direzione Generale

Ufficio Accordi e Relazioni Internazionali

ACCORDO CNR/TUBITAK -

PROGRAMMA DI RICERCA

Stato progetto:Rinnovo

Titolo italiano: Conservazione dei Beni Culturali: nanoprodotti innovativi per il consolidamento dei materiali lapidei impiegati nel bacino del Mediterraneo

Titolo inglese: Stone consolidation with innovative nanodispersive products for the conservation of cultural heritage in the Mediterranean Basin

Dipartimento di afferenza del progetto di ricerca: Scienze umane e sociali, patrimonio culturale

Proposta di ricerca: Stone consolidation treatments have a major role in the field of conservation science of Cultural Heritage. However, there is restricted knowledge on the efficiency of various consolidation products in terms of their performance, compatibility and durability in relation to the stone type and state of deterioration. Moreover, efficiency assessment of the consolidation treatments is a very complex issue due to the lack of common methodology defined with standard tests. In recent years, appropriate stone consolidation treatments targeted to the control of decay mechanisms have gained special importance. Lately, both laboratories contributed to the development of historic stone treatments with nanodispersive solutions and tests on their efficiency. Therefore, these laboratories would like to cooperate for the development of standard methods in order to verify the efficiency of the nanodispersive consolidation treatments and to fulfill the needs of the field on this particular subject. The ICVBC-CNR and METU-MCL laboratories have given importance to those subjects and studied several innovative consolidation treatments for historic stones, e.g., consolidation of limestones by forming calcite network through the use of nanodispersive calcium hydroxide solution, and consolidation of sandstones by forming silica network through the use of nanodispersive silica and silicate solutions. The stone consolidation treatments are expected to control the decay mechanisms, be compatible with the stone structure in the long run and improve physical and physicomaterial properties of the deteriorated stone. Consolidation of the historic stones by the formation of a compatible network within the microstructure of the stone is a requirement for the compatibility of the treatment. The products currently used showed limitations for their lack of durability and for their incompatibility with the stone materials. New products based on aqueous dispersions of calcium hydroxide and silica seem to be very promising. Both laboratories have given emphasis on those subjects and studied several nanodispersive consolidation treatments for historic stones, e.g., consolidation of limestones by forming calcite network through the use of nanodispersive calcium hydroxide solution, and consolidation of sandstones by forming silica network through the use of nanodispersive silica and silicate solutions. In this project, the more promising consolidation treatments by nanodispersive solutions will be selected, prepared and applied on limestone,

sandstone and marble samples in both laboratories. The efficiency of these consolidation treatments will be performed by artificial aging tests, determination of physical and physicochemical properties, such as colour, water absorption, and water vapor permeability, UPV, drilling resistance, dilatation properties, uniaxial compressive strength (UCS), and QIRT analyses. Verification of efficiency in microstructure of the stone will be done through Unilateral-NMR, SEM-EDX, XRD, FTIR, Raman Microscopy and image analyses by optical microscopy. The collaboration between METU-MCL and ICVBC-CNR, through this proposed experimental project, will allow a compared evaluation of the efficiency, also in the long time, of the nanostructured products and a selection of more significance tests and best procedures. Final result will be the formulation of a protocol for the efficiency assessment of nanodispersive treatments for the historic stones. In METU-MCL, the efficiency of consolidation treatments were studied with non-destructive methods of QIRT analyses and UPV measurements as well as with microstructural analyses. In recent years the ICVBC-CNR has developed new tests for the evaluation of consolidation/protection treatments for natural and artificial stones putting much emphasis on the drilling resistance measurements, superficial hardness tests and Unilateral-NMR studies. An important topic of the ICVBC-CNR is the development and standardization of tests to evaluate the conservation treatments for stone materials; the ICVBC researchers were founding members of the UNI-Normal and participate in the European Commission to develop standards in the field of Cultural Heritage. The collaboration between METU-MCL and ICVBC-CNR, through this proposed experimental project, will lead a critical review of tests for the evaluation of nanostructured inorganic consolidation products to arrive at the formulation of protocols to be proposed including in the European Commission CEN/TC346.

Obiettivi:

Based on the experience gained in the ICVBC-CNR and METU-MCL will be selected the most promising consolidation treatments for stone materials based on nanodispersive solutions of calcium hydroxide, silica and silicate. These products will be applied to stones of interest in the field of Cultural Heritage of the two countries. A joint experimentation will be conducted to evaluate their performance using both standardized than innovative tests with particular attention to those non-destructive and/or used in situ. The objectives are: -Evaluation of nanodispersive treatments for the consolidation of limestones and siliceous stones. In particular, will be considered the following aspects: identify the amount of the products to use and optimal application systems; chromatic changes; physical and physical-mechanical properties; compatibility of products with the microstructure of the stone; durability of the treatments after artificial aging. -Examination and discussion of the results obtained in two laboratories comparing methods used for assessing the significance of the tests in the different stone/treatment systems. -Development of a protocol for an evaluation methodology of nanostructured treatments. The results of this research that define the efficiency of the consolidation treatments and parameters related to it will also be useful for the care and maintenance of the historic buildings and will contribute to the development of consolidation materials and new building materials.

PIANIFICAZIONE DEL LAVORO

Piano di lavoro primo anno: Initial meeting between ICVBC-CNR and METU-MCL researchers to select: the stones to be used for experimentation choosing between Italian and Turkish stone materials (siliceous and carbonate stones); the nanostructured consolidation products and the preliminary tests for the choice of mode and time of treatment. Petrographic and chemical-physical characterization of stone materials selected. Preparation of specimens

for testing, choice of the amount of products to be applied on the basis of preliminary tests and applying treatments. Tests for determining the effectiveness of consolidation treatment with particular attention to techniques developed and validated by the ICVBC-CNR for the assessment of the increase of consolidation of the stone materials (DRMS, peeling and abrasion tests on paper) and their measure on the specimens before treatment. Visit of Turkish researchers to the laboratories of the ICVBC-CNR for the use of specific techniques developed by the institute for evaluating the consolidation effectiveness. Visit of Italian researchers at METU-MCL for the characterization of the samples through techniques developed in their laboratories (QIRT, UPV and dilatometry). Meeting between ICVBC-CNR and METU-MCL researchers for a critical examination of the initial results obtained before artificial aging of specimens.

Piano di lavoro secondo anno: Artificial aging of specimens. Tests for determining the effectiveness of consolidation treatments on aged specimens treated and untreated. Visit of Turkish researchers to the ICVBC-CNR laboratories for the use of specific techniques developed by the Italian institute. Visit of Italian researchers at METU-MCL for the characterization of the samples through techniques developed in Turkish laboratories. Final meeting between the researchers and ICVBC-CNR and METU-MCL for discussion of results and identification of most appropriate techniques to evaluate the effectiveness of consolidation treatments both respect to the reliability of the result that of the type of stone material. Proposal for a protocol to be used in the performance evaluation of nanostructured consolidation treatments on stone materials. Dissemination of results and presentation results in EU countries and in Turkey.

RESPONSABILE ITALIANO

Cognome: MECCHI

Nome: ANNAMARIA

Codice fiscale: MCCNMR49H59H501Y

Cellulare:

Email: annamaria.mecchi@cnr.it

[Visualizza il curriculum inserito](#)

Istituto: Istituto per la conservazione e valorizzazione dei beni culturali

Via e numero: Via Madonna del Piano 10, Edificio C **CAP:** 50019

Città Sesto Fiorentino **Provincia** FI

Telefono: 0555225480

Fax: 0555225403

RESPONSABILE STRANIERO

Cognome: Tavukcuoglu

Nome: Ayse

Codice fiscale: TVKYSA68D56Z243I

Cellulare:

Email: aysetavukcuoglu@yahoo.com

[Visualizza il curriculum inserito](#)

Istituto di appartenenza: Middle East Technical University-Department of Architecture

Indirizzo: Çankaya, Merkez

Città: Ankara

Nazione:

Telefono: +90 312 2106220

Fax: +903122107966

COLLABORATORI ITALIANI

Cognome: LUVIDI

Nome: LOREDANA

Codice terzo: 0

Matricola: 9505

Codice fiscale: LVDLDN65L61D810N

Istituto: ISTITUTO PER LA CONSERVAZIONE E VALORIZZAZIONE DEI BENI CULTURALI

Rapporto CNR: Dipendente

Posizione: III LIVELLO - RICERCATORE

Email: l.luvidi@icvbc.cnr.it

Curriculum allegato: [CV Luvidi_en 2013.pdf](#)

Cognome: MECCHI

Nome: ANNA MARIA

Codice terzo: 0

Matricola: 39370

Codice fiscale: MCCNMR49H59H501Y

Istituto: ISTITUTO PER LA CONSERVAZIONE E VALORIZZAZIONE DEI BENI CULTURALI

Rapporto CNR: Dipendente

Posizione: III LIVELLO - RICERCATORE

Email: a.mecchi@icvbc.cnr.it

Curriculum allegato: [CV Mecchi_en 2013.pdf](#)

Cognome: RESCIC

Nome: SILVIA

Codice terzo: 0

Matricola: 10987

Codice fiscale: RSCSLV69B49D612R

Istituto: ISTITUTO PER LA CONSERVAZIONE E VALORIZZAZIONE DEI BENI CULTURALI

Rapporto CNR: Dipendente

Posizione: III LIVELLO - RICERCATORE

Email: s.rescic@icvbc.cnr.it

Curriculum allegato: [CV RESCIC_EN-2013.pdf](#)

Cognome: SALVADORI

Nome: BARBARA

Codice terzo: 0

Matricola: 11371

Codice fiscale: SLVBBR73L66D612Q

Istituto: ISTITUTO PER LA CONSERVAZIONE E VALORIZZAZIONE DEI BENI CULTURALI

Rapporto CNR: Dipendente

Posizione: III LIVELLO - RICERCATORE

Email: salvadori@icvbc.cnr.it

Curriculum allegato: [CV Salvadori en 2013.pdf](#)

Cognome: DE PAOLI

Nome: MICHELA

Codice terzo: 179039

Matricola: 0

Codice fiscale: DPLMHL82E51H501R

Istituto: ISTITUTO PER LA CONSERVAZIONE E VALORIZZAZIONE DEI BENI CULTURALI

Rapporto CNR: Personale esterno

Posizione: DOTTORANDO

Email: michela.depaoli@uniroma1.it

Selezionato con procedura comparativa: No

Curriculum allegato: [CV De Paoli 2013.pdf](#)

COLLABORATORI STRANIERI

Cognome: Caner

Nome: Evin

Qualifica: project assistant

Curriculum allegato: [Evin Caner CV-1.pdf](#)

Cognome: Caner-Saltik

Nome: Emine Nevin

Qualifica: Professor

Curriculum allegato: [CV_Caner-Saltik_2013.pdf](#)

Cognome: Guney

Nome: B Alp

Qualifica: Research assistant

Curriculum allegato: [B Alp Güney CV.pdf](#)

Cognome: Tavukcuoglu

Nome: Ayse

Qualifica: Professor

Curriculum allegato: [CV_Tavukcuoglu_2013.pdf](#)

PROGRAMMA VISITE

Collaboratore: MECCHI ANNAMARIA

Soggiorno anno 2014

Durata (numero di giorni): 15

Periodo previsto: Febbraio

Programma di ricerca individuale: Kick-off meeting con il METU-MCL per selezionare i materiali lapidei (fra quelli più utilizzati in Italia e Turchia) da utilizzare per gli esperimenti; i prodotti consolidanti in nanodispersione e i tests preliminari per la scelta delle metodiche e dei tempi dei trattamenti. Programmazione delle successive tappe del progetto. Prove preliminari di caratterizzazione dei materiali e dei prodotti con le tecniche in possesso al Metu.

Soggiorno anno 2015

Durata (numero di giorni): 15

Periodo previsto: Ottobre

Programma di ricerca individuale: Final meeting al Metu-mcl sui risultati delle attività di laboratorio. Seminari per disseminazione dei risultati.

Collaboratore: LUVIDI LOREDANA

Soggiorno anno 2014

Durata (numero di giorni): 15

Periodo previsto: Febbraio

Programma di ricerca individuale: Kick-off meeting con il METU-MCL per selezionare i materiali lapidei (fra quelli più utilizzati in Italia e Turchia) da utilizzare per gli esperimenti; i prodotti consolidanti in nanodispersione e i tests preliminari per la scelta delle metodiche e dei tempi dei trattamenti. Programmazione delle successive tappe del progetto. Prove preliminari di caratterizzazione dei materiali e dei prodotti con le tecniche in possesso al Metu.

Soggiorno anno 2015

Durata (numero di giorni): 15

Periodo previsto: Ottobre

Programma di ricerca individuale: Final meeting al Metu-mcl sui risultati delle attività di laboratorio. Seminari per disseminazione dei risultati.

Collaboratore: SALVADORI BARBARA

Soggiorno anno 2014

Durata (numero di giorni): 15

Periodo previsto: Febbraio

Programma di ricerca individuale: Sopralluoghi in situ per selezione delle cave e campionatura dei materiali.

Soggiorno anno 2015

Durata (numero di giorni): 15

Periodo previsto: Ottobre

Programma di ricerca individuale: Final meeting al Metu-mcl sui risultati delle attività di laboratorio. Seminari per disseminazione dei risultati.

Stampa