APACHE

Active & intelligent Packaging materials and display cases as a tool for preventive conservation of Cultural Heritage.

MUSÉE DU QUAI BRANLY JACQUES CHIRAC

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814496

APACHE

Active & intelligent PAckaging materials and display cases as a tool for preventive conservation of Cultural HEritage.

Degradation of movable, tangible and indoor cultural heritage can be significantly increased by disadvantageous and unstable climate conditions, light, and intrinsic or external pollution. Preventive conservation aims to minimize aging and degradation by optimizing, among others, display and storage solutions. In the recent years, several active and intelligent packaging materials have been developed and put to use, especially in food industries. However, these materials are short-term solutions that cannot be easily adapted for cultural heritage, where long-term stability is mandatory. In the APACHE proposal, the novel combination of active novel packaging materials based on materials modelling, with sensors and wireless sensor technologies (WST) provides smart, low-cost easy-to-deploy systems for storage and exhibition of cultural heritage objects. One of the main goal of APACHE is to dramatically reduce the costs of mechanical climate control and monitoring systems, by developing and customising smart and affordable novel materials, based on material science advancements and discrete and continuum modelling.

The training organized by the European project APACHE and the musée du quai Branly - Jacques Chirac aims to explore the consortium's activities. It seeks to transfer knowledge generated during the development of the project within academic, professional potential users and industrial domains, in addition to upskill key stakeholders and staff on the use of the novel materials/tools/solutions applied to the preventive conservation of cultural heritage.

THE TRAINING FOCUSES ON THREE ESSENTIAL SECTIONS:

- *Lectures and presentations on the theoretical, research and implementation aspects of the novel materials and solutions*
- *Five practical workshops around the application methodologies and the use of some developed technologies*
- *A final open debate about the new materials, feedback and sharing of experience after the practical activities*

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FIRST DAY

09:00 – 09:10: Greetings

Preventive conservation: research and practicalities

CHAIR: ÉLÉONORE KISSEL,
musée du quai Branly - Jacques Chirac

09:10 – 09:30 Isella Vicini:

Cultural Heritage: funding opportunities in the new framework programme for research and innovation, Horizon Europe (2021-2027)

09:30 – 09:50 Antonio Mirabile:

Dissemination and public trainings approach

09:50 – 10:10 Fabrice Sauvagnargues:

Preventive conservation in practice at the musée du quai Branly - Jacques Chirac

10:10 – 10:30 Matija Strlic:

Modelling preventive conservation outcomes

10:30 – 10:45 Q&A

10:45 – 11:00 Coffee break

From micro to macro: materials and their interaction with the environment

CHAIR: LOÏC BERTRAND,
PPSM laboratory, ENS Paris-Saclay, CNRS, Université Paris-Saclay

11:00 – 11:20 Oscar Chiantore:

Indoor air quality in museums showcases: materials interactions, off-gasing, impacts

11:20 – 11:40 Ida Kraševec:

Monitoring protocols for pollutants in museums

11:40 – 12:00 Aysenur Iscen and Nancy C. Forero-Martinez:

Acrylic paints under the computational microscope

12:00 – 12:20 Alex Zabeo:

Apache Decision Support System supporting preventive conservation actions

12:20 – 12:40 Q&A

12:40 – 14:00 Lunch break

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Materials developed in the APACHE project to influence the environment

CHAIR: ANNE-LAURENCE DUPONT,
Centre de recherche sur la conservation des collections (CRCC)

14:00 – 14:20 Piero Baglioni:

Innovative "green" gels as new pollutant absorbers in Preventive Conservation

14:20 – 14:40 Gabriella Di Carlo:

Multifunctional materials based on chitosan for the removal of degrading species in museum storage/display environments

14:40 – 15:00 Romain Bordes:

Development of silica-based composites for the capture of gaseous pollutants in museums and archives

15:00 – 15:20 Panagiotis Goulis and Dimitrios Dragatogiannis:

Humidity sorption study using PVA membranes and Super Absorbent Polymers

15:20 – 15:35 Q&A

15:35 – 15:50 Coffee break

Sensors and solutions to describe and interact with the environment

CHAIR: NICOLAS WILKIE-CHANCELLIER,
Laboratoire SATIE, université CY

15:50 – 16:10 Daniele M. Trucchi:

Sensitive and selective electrochemical sensors for monitoring of museums crate atmosphere

16:10 – 16:30 Costas Galiotis:

Roll-to-roll graphene transfer as an effective tool for the protection of artworks

16:30 – 16:50 Dinesh R. Gawade:

A battery-less NFC sensor transponder for museum artefact monitoring

16:50 – 17:10 Manfred Anders and Steffen Ziemann:

Converting conventional passive into novel active archive boxes

17:10 – 17:30 Q&A

SECOND DAY

09:30 – 11:00

First cycle of practical activities

Manfred Anders and Steffen Ziemann:

Integration and practicability of regulators and sensing devices in archive boxes

Dinesh R. Gawade:

A battery-less NFC sensor transponder for museum artifact monitoring. Demonstration

Piero Baglioni and David Chelazzi:

Innovative "green" gels as new pollutant absorbers in Preventive Conservation

Alex Zabeo:

APACHE Decision Support System application in real collections case studies

Josep Grau-Bove and Himantha Cooray:

Using a decision making-tool to select the best storage enclosure.

11:00 – 11:15 Coffee break

11:15 – 12:45

Second cycle of practical activities

12:45 – 14:00 Lunch break

14:00 – 15:30

Third cycle of practical activities

15:30 – 15:45 Coffee break

15:45 – 17:15

Open debate about the new materials, feedback and sharing of experience after the practical activities

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ABSTRACTS AND SHORT CV

SECTION 1:

Preventive conservation: research and practicalities

Isella Vicini+

Warrant Hub S.p.A., Correggio (RE), Italy
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Cultural Heritage: funding opportunities in the new framework programme for research and innovation, Horizon Europe (2021 – 2027).

The EU has supported research and innovation in cultural heritage in its various forms - tangible, intangible and digital - through its framework programmes since 1986. Horizon Europe, starting on January 2021, is the 9th framework programme that will bring new inputs and will give new perspectives to innovation in the Cultural Heritage field, opening new opportunities of funding thanks to specific instruments such as the Innovation Fund and the EIC accelerator. Moreover, the next 7 years of Horizon Europe will be focused on environment and sustainability and new opportunities will open also for Cultural Heritage inside the European Green Deal and LIFE Programme. Isella Vicini will give an overview of funding opportunities and instruments for the cultural heritage sector, explaining how to make the most of European funding programmes.
Isella Vicini is the Director of the European Funding Development of Warrant Hub S.p.A and the CEO and founder of beWarrant, a Belgian consultancy company that provides support on European Funding opportunities. She has a wide experience in the EC Research and Innovation programmes, like Horizon 2020 and LIFE Programme. Since the First Framework Program (1985), she works in the European Project Design field, taking care of the complete cycle of a project: from the analysis of the sectorial policies to the conclusion of the research and innovation project. She currently manage a team of 16 people and her European Funding Development provides 80 consultancy services per year, it is involved in 51 projects and it manages 151 million euros Horizon 2020 grant. Isella is the Project Coordinator of the EU funded project Repair3D and the founder and Dissemination Manager of ECHOES, the EC Cluster on Cultural Heritage.

Antonio Mirabile+

Atelier Mirabile, Paris, France
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Dissemination and public trainings strategies

The importance of disseminating knowledge and results from research projects has been recognised by the EC as one of its priorities (COM(287)182 final). Dissemination of results is a contractual obligation of participation in research initiatives supported under the European Union's Horizon 2020 research and innovation programme. The specific aims of this provision are to promote knowledge sharing, greater public awareness, transparency, and education. The dissemination involves not only looking at where and when the information should be disseminated but also what should be communicated and how it should be presented. This presentation shows the key vision of the APACHE Consortium in view of sharing and therefore exploiting the open knowledge gathered and generated within the project.

The Antonio Mirabile SME has been working since 1995 in the field of conservation. Its activities are devoted to paper conservation and preventive conservation of cultural heritage. Antonio Mirabile SME has been working regularly for public (Pompidou, Carnavalet, Bourdelle, ENSB-A) and private (Fondation Guerlain) collections as well as for UNESCO projects (Egypt, Uzbekistan, Mongolia, DPRK…). Particular area of expertise includes: collection and risk assessment, risk management, multidisciplinary collaboration, storage organisation, maintenance work, cultural heritage management and care. The SME has been involved in the organization of different seminars; teaching projects and has regular collaborations with different research institutes.

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Fabrice Sauvagnargues+

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Preventive conservation in practice at the Musée du quai Branly – Jacques Chirac

The author will present the array of preventive conservation procedures set up in order to preserve over 370 000 non-European ethnographic objects as well as vast graphic arts, photographic, library and archival holdings. The on-going actions include Integrated Pest Management, climate monitoring and control, light, microfading and vibrations measurements. Analysis to identify pesticide residues are also performed routinely. More recently, through the APACHE collaboration, VOC sensors were set up for the first time in exhibition spaces and storage rooms.

Fabrice Sauvagnargues graduated from the École du Louvre and from the University of Paris 1 Pantheon-Sorbonne in Archaeology of Sub-Saharan Africa. Fabrice joined the musée du quai Branly - Jacques Chirac in 2009 as an art registrar before taking charge of the preventive conservation in 2014

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Matija Strlič+

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Modelling preventive conservation outcomes

The two schools of decision-making, synoptic and incremental, each have followers in preventive conservation. Incremental decisions are based on the notion that solutions are very complex, that decisions therefore do not have an end goal in themselves, and that the process is ongoing. In contrast, synoptic decision making requires an assessment of possible outcomes, based on which the optimal choice can be made within given practical constraints. This is desirable, as it increases transparency and can respond to rapid and significant shifts in management. For some heritage materials and collections such decision making is possible, since we know how to model the consequences of conservation decisions, e.g. the long-term effects of a 4 oC, or 10% RH, or 10 ppm NO2 decrease. This can be achieved by using damage functions, and some of these have been made available as online apps, which the presentation will introduce.

Matija Strlic is Professor of Heritage Science at University College London, Professor of Analytical Chemistry at University of Ljubljana and Senior Research Fellow at the Smithsonian's Museum Conservation Institute. His research focuses on heritage materials and collections, as well as their interactions with the environment. His current interests include development and use of damage functions and integrated modelling of heritage collections. He published more than 160 peer-reviewed papers in the field of heritage science, the majority of which are related to conservation and degradation of organic materials. He is an accredited conservator, Fellow of the International Institute for Conservation and Fellow of the Royal Society of Chemistry.

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SECTION 2:
From micro to macro: materials and their interaction with the environment

Oscar Chiantore+

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Indoor air quality in museums showcases: materials interactions, off-gassing, impacts.

The control of air quality in museum showcases is of growing importance for the conservation of the displayed artefacts. Inside an airtight showcase volatile substances may rapidly concentrate and favour or directly cause degradation or other unwanted phenomena on the objects. The role of materials, either used for construction and decor of the museum display cases or being artworks constituents, as source of pollutants and volatile compounds dangerous for the cultural heritage integrity will be discussed with illustration of consequences and critical damages. Ways of assessing the suitability of materials used either in the construction and use of the display cases are also critically examined, altogether with an overview of the possible choices for monitoring the air quality and limiting the concentration of volatile compounds in their interior.

Oscar Chiantore is scientific consultant and research project manager with the Goppion company. Research scientist and past Chair of Chemistry and Technology of Polymers at the University of Torino. Chairman of the Curriculum in Science and Technology for Cultural Heritage at the University of Torino from 2001 to 2006. Chairman of the Interfaculty School in Conservation - Restoration of Cultural Heritage, University of Torino and Centro Conservazione e Restauro La Venaria Reale, from 2006 to 2012. Former active member of the IUPAC working group on "Characterization of Industrial Polymers" and of the UNI-NORMAL Commission for protection of stone artefacts. Emeritus Governing Board Member of ISPAC, international organization for research in the field of polymer characterization. His research specialization in polymer science is about the chemistry, characterization and degradation behaviour of macromolecular compounds, with particular attention at the analysis and properties of organic compounds in cultural heritage, at the design, development and testing of new polymers as coatings, adhesives or consolidants for conservation applications, the ageing and conservation of polymer materials in contemporary art, the emission and control of volatile compounds from polymers and from organic based materials in general.

Ida Kraševec+

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Monitoring protocols for pollutants in museums

The presence of pollutants in the indoor air is known to contribute to the degradation of heritage objects stored or displayed in heritage institutions. Among these, acetic and formic acids are known to have harmful effects on pigments and metals, as well as on some objects of organic origin. In the course of the APACHE project, we developed and validated several methods for monitoring of pollutants in museum environments, based on passive sampling. The methods were used in collaboration with seven European museums, where pollutant monitoring was performed in every season of the year.

Ida Kraševec is a researcher at the Department of Analytical Chemistry at University of Ljubljana, where she also obtained her PhD. Currently she focuses on developing methods for characterisation of compounds, emitted from heritage objects and the surrounding materials based on both active and passive sampling techniques.

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Aysenur Iscen+ and Nancy C.Forero-Martinez+

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Acrylic paints under the computational microscope

Damage in cultural heritage conservation emerges from the interplay of various complex processes occurring at the microscopic scale. Through a multi-scale computational methodology, we aim at a fundamental understanding of these processes in acrylic materials present in both contemporary paintings and storage packaging. We focus on the canvas' paint layer and recreate environmental and storage conditions at the molecular scale. Hence, we explicitly include the polymers used as binders in the acrylic paints and prototypical volatile organic compounds (VOCs). Here, we discuss the interaction between polymers and VOCs as a diagnostic tool to quantify the impact on the materials lifetime.

Aysenur Iscen is a postdoctoral researcher working under the supervision of Kurt Kremer at the Max Plank Institute for Polymer Research. She earned her B.S degree in chemical engineering from Yeditepe University in Istanbul, Turkey. She completed her PhD in chemical and biological engineering with Prof. George C. Schatz at Northwestern University in 2019, where she developed computational methods to develop bio-inspired materials.

Nancy C. Forero-Martinez is a postdoctoral research assistant in the Theory Group at the Max Planck Institute for Polymer Research. She earned Physics and MSc. degrees at the Universidad Nacional de Colombia and a PhD degree at Queen's University Belfast. Her research focuses on studying the optical, electronic and structural properties of nanoscale materials using multiscale simulations. Currently, she investigates the thermodynamic and surface properties of polymers and ionic liquids.

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Alex Zabeo[+#1], Elena Semenzin[1], Giacomo Chiarot[1], Alison Heritage[2], Antonio Mirabile[3]

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2 - International centre for the study of the preservation and restoration of cultural property, Rome, Italy
3 - Atelier Mirabile, Paris, France

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 # Trainer

Apache Decision Support System supporting preventive conservation actions

During this presentation the Apache Decision Support System (DSS) web application will be introduced, its main aims and functionalities will be presented as well as selected exemplificative case studies from the Apache project. The DSS is composed of two tiers of increasing detail. The first tier is an introductory wiki style guideline for generic preventive measures' application while the second tier is a detailed support system tailored to the user's institution and collected artworks.

Alex Zabeo is senior Researcher, Ph.D. in Informatics. His research activities focus on Decision analysis, Probabilistic Risk Assessment and Life Cycle Assessment. He has proven expertise in project and development of standard and Geographical Decision Support Systems (DSS) and in Multi-Criteria Decision Analysis (MCDA) - Fuzzy Logic (FL) - Value of Information (VoI) – Artificial Intelligence (AI) based assessment methodologies as well as in design and realization of studies and software related to Life Cycle Assessment (LCA) and management of complex sensors' networks and Internet of Things (IoT). He's been guiding the Decision Support area of several European and National projects.

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SECTION 3:
Materials developed in the APACHE project to influence the environment

Piero Baglioni[+#], David Chelazzi[#], Rodorico Giorgi, Marianna Mamusa, Giulia Moretti, Giovanna Poggi and Claudio Resta

Department of Chemistry and CSGI, University of Florence, Italy
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 # Trainer

Innovative "green" gels as new pollutant absorbers in Preventive Conservation

Currently, there is a need in Preventive Conservation (PC) for practical and affordable pollutant absorbers, so as to favour the preservation of vast collections or enclosures where the use of expensive filters is not possible. The absorbers should be easy to use, renewable or easily replaceable, and made of environmentally friendly materials. Castor oil (CO)-based gels are optimal candidates to meet these requirements: CO is a "green" biopolymer that can be used to formulate gels or hybrid networks where chemical absorbers, targeted to specific VOCs, are included. The seminar will discuss recent formulations of CO gels and hybrids, which are being developed in the H2020 APACHE project (Active & Intelligent Packaging materials and display cases as a tool for preventive conservation of Cultural Heritage) as absorbers for aldehydes, acetic acid and formic acid.

Piero Baglioni is Professor of Physical Chemistry in the Department of Chemistry at the University of Florence and is a MIT affiliate. He is on the editorial/advisory boards of several international journals and a member of the scientific board of several national and international Institutions and societies. He is the author of more than 480 publications and 25 patents in the field of colloids and interfaces and a pioneer in the application of soft matter to the conservation of Cultural Heritage.

David Chelazzi received his Master's Degree in Chemistry from the University of Florence (Italy) in 2003 and went on to obtain his Ph.D. degree in Science for Cultural Heritage Conservation in 2007 under the mentorship of Piero Baglioni. He is currently a researcher at the University of Florence (Department of Chemistry and CSGI). His research interest is in the development of advanced and nanomaterials for the conservation of works of art. He is author and co-author of more than 55 papers including leading peer-reviewed international journals in the field of physical-chemistry, conservation science, and environmental science. He has been (and is) involved in European and national projects on the development of advanced materials and solutions for the preservation of cultural heritage (FP7 NANOFORART 2011-2014, POR FESR 2007 -02103 TeCon@BC 2011-2012, H2020 NANORESTART 2015-2018, H2020 APACHE 2019-ongoing).

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Gabriella Di Carlo+, Elena Messina, Maria Paola Staccioli, Monica Albini, Marianna Pascucci, Cristina Riccucci, Gabriel M. Ingo

Institute for the Study of Nanostructured Materials (ISMN), National Research Council (CNR), Rome, Italy
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Multifunctional materials based on chitosan for the removal of degrading species in museum storage/display environments

The ability of chitosan-based materials to selectively interact with degrading species (such as organic acids and aldehydes), dangerous for the cultural heritage objects, can be used to create a stable micro-environment in storage and display cases. The performance of these materials can be optimized by controlling their chemical functionalities and by introducing appropriate fillers. This issue is addressed within the EU APACHE project aimed at the development of new solutions for the preventive conservation of cultural heritage.

Gabriella Di Carlo, PhD in Chemistry, is Senior Researcher at ISMN-CNR in Rome. Her main research interests include the development of innovative materials and technologies for the sustainable conservation and fruition of Cultural Heritage. She works on surface studies at micro and nanoscale with multianalytical approaches and on the synthesis and validation of smart nanostructured materials. Her activities are mainly conducted within national and international projects (as ongoing H2020 InnovaConcrete and Apache projects). She has co-authored about 75 publications on international ISI journals receiving more than 3300 citations and with an H index of 28.

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Romain Bordes+

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Development of silica-based composites for the capture of gaseous pollutants in museums and archives

Volatile organic compounds (VOCs) are major air pollutants causing environmental and health issues. This matter becomes particularly critical when VOCs are present in closed or poorly ventilated places with low air flow, as in museums, archives and storage, where they will cause degradation of objects. One of the most promising technologies in preventive conservation can therefore be adsorption with cost-effective and reliable materials. Silica-based materials are of high interest as silica is cheap, abundant, safe and environmentally benign. Furthermore, surface functionalization enables capturing a broad range of pollutants.

This presentation describes the production and characterization of silica-polyethyleneimine (PEI) composites, suited for adsorption of the small organic pollutants commonly encountered in museums, i.e., formaldehyde, acetaldehyde, acetic acid and formic acid. The functionalization of silica was done using PEIs with different characteristics (different molecular weights and degrees of branching) at various loadings (5-65wt%). VOCs adsorption kinetics were measured in real-time using in-situ diffuse reflectance infrared Fourier transform spectroscopy-mass spectroscopy (DRIFT), as well as differential scanning calorimetry-mass spectroscopy. The results gave insights on the detailed mechanism of adsorption, and allowed correlating VOCs adsorption behavior with the type of silica and PEI, highlighting the importance of PEI branching in the adsorption mechanism. This study underscores the importance of material design in prevention conservation and throw principles of design to balance performance versus cost of novel adsorbent for museum climate control.

Romain Bordes is leading a researcher group at the division of Applied Chemistry at Chalmers University of Technology, Gothenburg, Sweden. With a background on surfactant chemistry, he has oriented his research activities towards the fundamental and applied aspects of dispersed systems. In 2015, he started using novel surfactants and nanomaterials for the conservation of works of art, with strong emphasis on using nanocellulose and silica-based materials. This research continues now with preventive conservation applications.

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Panagiotis Goulis, Andronikos Balaskas, Dimitrios Dragatogiannis, Costas A. Charitidis+

National Technical University of Athens (NTUA), Athens, Greece
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Humidity sorption study using PVA membranes and Super Absorbent Polymers

The aim of this study is to examine the conditions for a successful integration of relative humidity and temperature regulators as well as their mode of action in enclosures for cultural heritage inside storage boxes. Super absorbent polymers are partially cross-linked, three-dimensional polymer networks that can absorb and retain liquid. Polyvinyl alcohol based membranes demonstrate moisture sorption properties with minimal ecological impact. In this work, these two materials are tested, concerning their sorption properties under controlled conditions, in order to investigate their effectiveness in protecting sensitive items from humidity over the course of time.

Costas Charitidis is Professor in the School of Chemical Engineering of the National Technical University of Athens (NTUA) and Director of the Research Unit of Advanced, Composite, Nano Materials & Nanotechnology. From 2011 he is Director of the Interdisciplinary Postgraduate (MSc) Program: Materials Science & Technology (NTUA). He has more than 25 years of experience in the fields of Materials Science & Nanotechnology, Carbon-based materials and Safety impacts of Nanotechnology. He has extensive research and development experience through collaborations with International research centers and industry, since he has participated in more than 60 European and National funded projects, in 15 of them as Scientific Coordinator (most recent are: Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, Resource Efficient Economy with a Sustainable Supply of Raw Materials NMP FP7, Horizon 2020). He is a referee in International Scientific Journals, evaluator and scientific advisor of research and development projects. He is the author of more than 240 scientific publications in peer reviewed international journals and conference proceedings, scientific books and chapters in international text books. He has received more than 4900 citations by other researchers (h-index 38).

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SECTION 4:

Sensors and solutions to describe and interact with the environment

Daniele M. Trucchi+ on behalf of DiaTHEMA Lab of CNR-ISM, CNR-ISMN, and Ionvac Process Srl

National Research Council of Italy, Institute of Structure of Matter, DiaTHEMA Lab
+ Presenting and corresponding author

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Sensitive and selective electrochemical sensors for monitoring of museums crate atmosphere

The development of low-cost sensitive and selective sensors for correctly monitoring the atmosphere immersing artistic and historic artifacts is one of the main aim of the frontier technology applied to cultural heritage. The presentation will report the past and the present state-of-the-art technology, so to successively discuss the technology and results achieved under the APACHE project.

Daniele M. Trucchi has a Ph.D. in Electronic Engineering. Since 2010 he has been leading the DiaTHEMA Labs of CNR-ISM, the activities of which are the design, development, and fabrication of innovative radiation detectors, electronic devices, energy converters by exploiting the optimized physical properties of advanced materials. He coordinated the activities of several FP7 and H2020 projects, mainly aimed at developing materials and efficient high-temperature converters for solar concentration, aimed at developing fast neutron detectors and high-temperature microtechnologies. He is author of more than 100 papers on refereed international scientific journals, of 1 book chapter, and inventor of 2 patents on materials science and energy conversion.

Maria Kostidi[1,2], George Gorgolis[2] and Costas Galiotis[1,2,+]

1 - University of Patras, Patras, Greece
2 - Foundation for Research and Technology – Institute of Chemical Engineering Sciences, Greece

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Roll-to-roll graphene transfer as an effective tool for the protection of artworks

All art materials are generally prone to degradation. In particular, the 20th century cultural heritage shows short lifetime expectancy due to the introduction of novel materials and techniques. Graphene-related materials have been found to provide considerable ultraviolet shielding as coatings, while a single layer CVD graphene absorbs up to 3 times more in the UV region (190-400 nm), than in the visible range. Additionally, chemical molecules such as water or oxygen cannot penetrate a continuous graphene membrane providing the ultimate shield against degradation. An invisible veil of graphene could provide protection for old and contemporary paintings against all these factors.

Costas Galiotis is a Professor at the Chemical Engineering Department of University of Patras and Collaborating Faculty Member of the Institute of Chemical Engineering Sciences of FORTH (FORTH/ ICE-HT). He graduated from the University of Athens in 1977 and received his PhD from the University of London (Queen Mary College) in 1981. From 1985 till 1997 he served as a member of professorial staff at Queen Mary University of London. He moved to Greece in 1997 as a Research Director FORTH and was appointed Professor at the University of Patras in 2002. From 2007 till 2013 he acted as the Director of FORTH/ ICE-HT. Since 2017 he serves as the Director of the Physical Sciences programme of the HFRI (Greece) and in the Executive Board of the European Graphene Flagship. His current research interests are in the areas of nano and micro-mechanics, graphene and also preventive conservation of art objects. He has published approx. 300 journal papers, book chapters and reviews which have been cited over 18000 times (GS). He is the Editor-in-Chief "Graphene Technology" (Springer-Nature) and Editorial Board Member of "Scientific Reports" (Nature). He is a fellow of the European Academy of Sciences and of the Institute of Materials, Minerals and Mining (IOM3).

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Dinesh R. Gawade[1+#], John Buckley[1], Brendan O'Flynn[1], Daniela Iacopino[1], Steffen Ziemann[2] and Manfred Anders[2]

1 - Tyndall National Institute, University College Cork, Ireland
2 - ZFB Zentrum für Bucherhaltung GmbH, Leipzig, Germany
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 # Trainer

A battery-less NFC sensor transponder for museum artefact monitoring

This presentation presents a recently developed, low-cost, battery-less Near-Field Communication (NFC) sensor transponder for the museum artifacts monitoring of Cultural Heritage objects as part of the APACHE project. The developed sensor transponder combines a unique combination of packaging materials and NFC technology to enable a low-cost preventive conservation solution that is practical to implement, something that is not commercially available at the present time. The developed transponder wirelessly monitors temperature and humidity conditions inside cardboard artefact storage boxes and only requires a smartphone to operate. The transponder has been specifically designed with low cost in mind. The presented wireless sensor design meets key requirements for museum archive monitoring applications such as a low-cost implementation (5 in quantities of 10k), near-field communication range (4 cm), and shelf life (5 Years).

Dinesh R. Gawade received a Bachelor's of Technology Degree in 2016 from the Department of Technology, Shivaji University, India in Electronics and Communication Technology. After graduation, he worked in the electronics industry for 2 years as a hardware design engineer from 2016 until 2018. He then worked as an academic researcher at the Indian Institute of Technology Mandi (IITM), India as a project engineer (Hardware design) before joining Tyndall National Institute in 2018. Presently in Tyndall, Dinesh is pursuing a MEngSc degree within the Antenna and RF Design team in the WSN group. He is a member of T-UCC research team, who developed a battery-less sensor transponder for the APACHE project.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814496

Manfred Anders[+ #] and Steffen Ziemann[+ #]

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 # Trainer

Converting conventional passive into novel active archive boxes

As one of the processing enterprises among the APACHE partners, ZFB deals with customer-oriented solutions for conservation of cultural heritage as well as the conception, development, manufacturing and distribution of archive boxes made of corrugated board. Contributing to the projects' objectives of creating active & intelligent storage enclosures, ZFB's research department strongly focuses on the creation and preservation of desirable interior climate conditions via optimizing conventional corrugated board enclosures. Constant knowledge transfer with sensor developers additionally promotes a user-friendly utilization of wireless sensing devices in the final application. To outline the process of converting conventional passive into novel active archive boxes, the main topics highlighted in ZFB's presentation will address improved box constructions and materials, an application-driven evaluation of novel T/RH/VOC regulators and intelligent measures for their integration.

Manfred Anders is specialist for paper-, cellulose- and textile chemistry. He received his PhD "Analysis of paper ageing and preservation of damaged papers by deacidification and consolidation" at the University of Stuttgart in 2000, held teaching assignments in Reutlingen and Hildesheim and has been a member of the IADA board from 1999-2007. Since 2002 he works as CEO of ZFB Zentrum für Bucherhaltung GmbH.

After studying chemistry at the Friedrich-Schiller-University Jena and receiving his PhD in metal-organic & inorganic chemistry, Steffen Ziemann joined ZFB Zentrum für Bucherhaltung GmbH 2019, where he works as researcher for preventive-conservational product innovation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814496

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Josep Grau-Bové is an expert in heritage microenvironments and their effect on historic collections. He research focuses on using computational tools to improve preventive conservation.

Himantha Cooray is specialised in computational modelling and applied mathematics related to fluid mechanics. He currently develops models to understand the microclimate in museum storage boxes and display cases.

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Trainings

Manfred Anders and Steffen Ziemann: Integration and practicability of regulators and sensing devices in archive boxes

- Examples of customized storage solutions for special applications in archives / museums will be presented
- Improved box constructions / materials will be shown
- The utilization of an integrated T/RH sensor transponder can be tested
- Modular combinability of T/RH/VOC absorbents or regulators with the storage enclosures will be demonstrated and can be tested

Dinesh R. Gawade: A battery-less NFC sensor transponder for museum artifact monitoring. Demonstration

- Overview of battery less NFC sensors transponder hardware and functionalities
- Working principle and demonstration of sensor transponder, outsid cardboard box
- Museum archived artifact monitoring concept demonstration using battery-less NFC sensor transponder
- Hands-on practice with museum archived artifacts monitoring using a battery-less NFC sensor transponder

Piero Baglioni and David Chelazzi: Innovative "green" gels as new pollutant absorbers in Preventive Conservation

- Introduction to organogels
- Demonstration of gels features and handling
- Criteria for the gels selection according to the VOC/VOCS to be removed
- How to apply gels

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APACHE PROJECT: FIRST PUBLIC TRAINING MUSÉE DU QUAI BRANLY - JACQUES CHIRAC

Alex Zabeo: APACHE Decision Support System application in real collections case studies

Log in and user preferences management

Navigating tier 1 generic preventive measures information

Registering a new institution in tier 2

Adding locations, rooms and artworks

Navigating through specific preventive measures' suggestions

Reading data from sensors and managing harmful conditions

Josep Grau-Bove and Himantha Cooray: Using a decision making-tool to select the best storage enclosure.

This activity is a demonstration of a digital tool to help decision-makers choose the best enclosure given a certain environment and preservation priorities.

Participants will learn how to use the digital tool. They will also learn are the main parameters that define the environment within an enclosure.

Users will be able to upload real environmental data provided by the trainers and explore in the computer how different boxes will create different microclimates.

The tool includes parameters such as buffering materials, wall material, thickness of the walls, and ventilation holes in the box.

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Organisation:
Antonio Mirabile - APACHE Project
Eléonore Kissel - Musée du quai Branly - Jacques Chirac

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Graphic Design: saraprince.net

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APACHE

Active & intelligent Packaging materials and display cases as a tool for preventive conservation of Cultural Heritage.

ORGANISATION

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MUSÉE DU QUAI BRANLY
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