

# CeROArt

Conservation, exposition, Restauration d'Objets d'Art

Education and Research in Conservation-Restoration

Communications

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## Education and Research in New Materials: Looking at the market, working with manufacturers

SILVIA G. FERNANDEZ-VILLA, MARGARITA SAN ANDRÉS, RUTH CHÉRCOLES ET ISABEL M. GARCÍA

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### *Résumés*

Français English

La recherche est un élément fondamental dans le développement et l'amélioration de l'enseignement, tout particulièrement dans le domaine de la conservation et de la restauration. Cet article détaille un exemple concret sur les liens, les bénéfices et les synergies entre la recherche et l'éducation dans le cadre de l'étude des matériaux polymériques utilisés pour la conservation et la restauration de patrimoine.

Research is a core element for the development and improvement of education, especially in the field of Conservation and Restoration of Heritage. This article shows a particular example of the linkages, benefits and synergies between research and teaching in the context of the study and analytical characterisation of the new polymeric materials used in conservation.

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### *Entrées d'index*

**Mots-clés :** restauration, conservation, recherche, éducation, polymères

**Keywords :** restoration, conservation, education, research, polymers

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### *Texte intégral*

The authors would like to acknowledge the projects that have supported the research: Evaluation of products used in conservation and restoration of cultural property (Ref: 252/2008), Synthetic polymers used in conservation and restoration of heritage objects. Characterization and evaluation of their long-term behaviour (Ref. CTQ2010-20831) and Synthetic Polymers. New uses and benefits in the conservation and

restoration of cultural heritage (HAR2015-68680P) funded by the Ministry of Science and Innovation.







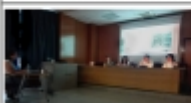
## Introduction

- 1 As is well known, research in the field of conservation and restoration is fundamental and requires constant updating of knowledge, as well as the interdisciplinary work which is also necessary for the proper development of teaching in this area. This communication aims to show how different research activities can benefit the education received by students. Along the same lines, the application of knowledge to the planning and development of teaching assignments can also benefit the teacher/researcher and promote the development of future research actions.
- 2 It is intended to show how research and teaching come together and create synergies in a specific field: the conservation of synthetic polymers. The research group *Documentation, preservation and conservation techniques* (Ref. 930420) has been working in this field for a number of years (SAN ANDRÉS ET AL., 2011a). The members of this group are also teachers on the Degree in Conservation of Cultural Heritage which has been taught at the Faculty of Fine Arts, Complutense University of Madrid since 2011. We will therefore show how the development of research projects has been applied to the teaching of different subjects.

## Research and Education at the Bachelor's Degree in Conservation of Cultural Heritage, University Complutense, Madrid

- 3 The Degree in Conservation of Cultural Heritage is an interdisciplinary course consisting of 240 ECTS credits spread over four academic years, of which 60 credits correspond to basic training, 162 to mandatory courses, 12 to optional courses and 6 to the dissertation (fig. 1). The first module, called "Basic training", is taught in the first year and focuses on practical teaching in fine arts and humanities. The second module, known as the "Fundamental module", tackles the study of the technical and historical materials associated with heritage and their degradation mechanisms. It is made up of subjects grouped into "Auxiliary sources" and "Material sciences". A third module, the Advanced one, corresponds to the criteria and methods of intervention in real pieces of cultural heritage and their enhancement, including subjects relating to the conservation of paintings, sculptures, mural paintings and contemporary art.

**Fig.1 Structure of the Degree in Conservation and Restoration of Cultural Heritage (University Complutense de Madrid)**

MODULE		ECTS CREDITS	DESCRIPTION
	<b>1. BASIC TRAINING</b>	60	Practical teaching in fine arts (sculpture, drawing and painting basics), History of Art and Basic Concepts on Conservation
	<b>2. FUNDAMENTAL MODULE</b>		Study of technical and historical materials associated with heritage Degradation mechanisms
	Auxiliary Sources	42	
	Materials Science	48	Criteria and methods of intervention in real pieces of cultural heritage and their valorization
	<b>3. ADVANCED MODULE</b>		Criteria and methods of intervention in real pieces of cultural heritage and their enhancement
	Conservation-Restoration of Paintings	36	
	Conservation-Restoration of Sculpture	24	
	Conservation-Restoration of Contemporary Art	12	
	<b>4. OPTIONAL COURSES</b>	12	Extension of conservation projects New technologies applied
	<b>5. FINAL PROJECT</b>	6	Defense of a mentored conservation project Evaluation of the knowledge and skills acquired

Modules, credits and main contents.

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- 4 The optional module includes subjects on the extension of conservation projects and the new technologies applied. Once the students have completed the above previous credits, they will be ready to complete their dissertation, the main aim of which is to verify and assess the skills acquired. This involves the completion and defence of a mentored individual project of a theoretical and practical nature which allows the knowledge and skills acquired by the student throughout his education to be verified.
- 5 The teaching methodology on this degree is both theoretical and practical, although the latter aspect predominates in most subjects. The main feature of these studies is the application of the knowledge acquired on real works of art, as well as laboratory practice, thereby ensuring that students receive quality training.
- 6 Most teachers on the degree hold a PhD specialising in different areas such as the conservation of painting and sculpture, history of art, museology, applied sciences and new technologies. Aware of the huge importance of research with regard to the quality of teaching, most of them actively participate in groups and research projects funded by different public institutions, as well as innovative teaching quality projects funded by the Complutense University itself. These focus on the development of new educational procedures or new tools to extend learning methods.
- 7 Of the research groups made up of teachers on the degree, one of the most well-established is the research group *Documentation, preservation and conservation techniques*, which forms part of *TechnoHeritage* (a network of research groups for the conservation of cultural heritage), as well as the Heritage Cluster of the Moncloa, International Campus of Excellence. As mentioned previously, it is an interdisciplinary group made up of scientists, conservators, historians and museologists.
- 8 This consolidated group was validated by the UCM in 2004 and since then has been funded by consecutive grants. It has developed its research in the following fields:
  1. Artistic technology. Production and use of artistic materials throughout history
  2. Techniques for physical analysis of heritage objects and analytical characterisation of artistic materials

3. History and criteria of conservation
4. Museology, museography and preventive conservation
5. New conservation treatment methods such as new cleaning systems and also the control of their effects on the paint layer.
6. Polymers and plastics industry and their relationship with the conservation of heritage objects.

9 Of all these lines of research, the main one on which the group has focused its research is the last one, the study of polymers and their application in the field of conservation. It includes the evaluation of synthetic polymeric materials used in preservation and conservation treatments as well as the analytical characterisation and study of their long-term behaviour. It is therefore an illustrative example of the synergies that must necessarily be established between research and teaching.

## Research Projects on Polymers and New Materials

10 The existence of a variety of synthetic polymers and advances in processing technologies is responsible for the wide range of materials on the market. Many of them are used in preservation and conservation processes and are well accepted in the field of artistic production.

11 Most of these materials have not been developed for this purpose and tend to have a complex composition and structure. It was therefore necessary to establish a research methodology aimed at identifying their composition, properties and long-term behavior. Since 2009 this research team has participated in three projects related to the study of polymeric materials used in conservation and restoration.

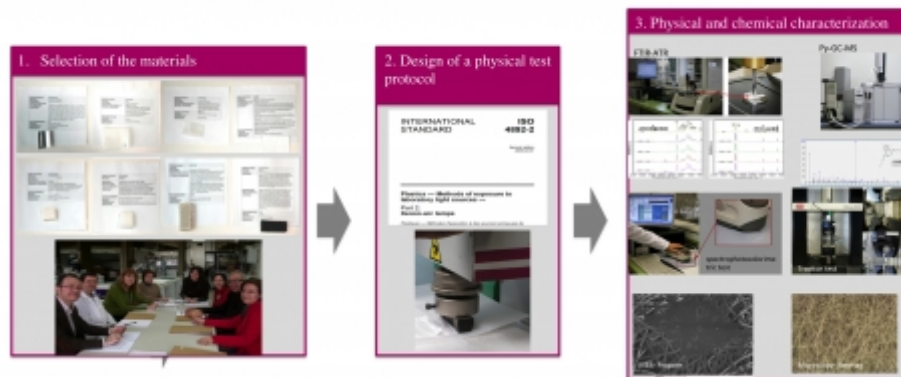
12 The competitive projects developed and still on-going are as follows:

- *Evaluation of products used in conservation and restoration of cultural property* (Ref: 252/2008). It was a Collaboration Project between the Complutense University and the Directorate of Fine Arts and Cultural Property of the Ministry of Culture and it was developed between March 2009 and April 2012.
- *Synthetic polymers used in conservation and restoration of heritage objects. Characterization and evaluation of their long-term behaviour* (Ref. CTQ2010-20831). It was supported by Ministry of Science and Innovation and the Complutense University and developed from January 2011 to December 2013.
- *Synthetic Polymers. New uses and benefits in the conservation and restoration of cultural heritage*. This research project is in fact in progress and financed by Ministry of Science and Innovation and it will be concluded on March 2019.

13 The main aim of the first two projects was the prior study of the products used in conservation, in order to select those that meet the criteria of stability and compatibility with cultural heritage materials.

14 The following stages were considered in order to achieve this aim (Fig.2 and Fig.3):

**Fig.2 Steps 1 to 3 of the research projects on the stability of polymers used in conservation**



Collaboration Project 252/2008 and Research Project CTQ2010-20831

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**Fig.3 Steps 4 to 6 of the research projects on the stability of polymers used in conservation**



Collaboration Project 252/2008 and Research Project CTQ2010-20831

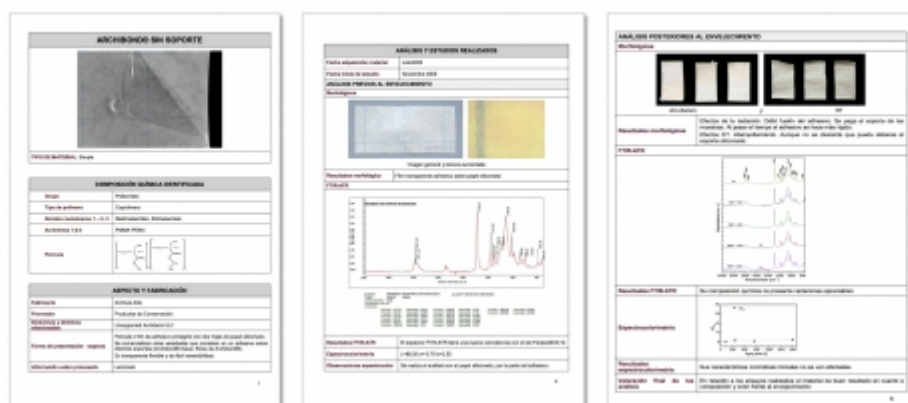
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1. Selection of the materials used in different disciplines (painting, sculpture, stone materials, archaeology and graphic documents). Restorers and museum curators and the archives of the Spanish Cultural Heritage Institute were consulted, providing practical applications and experiences of the products used (GÓMEZ ET AL., 2011) (SAN ANDRÉS, 2010a).
2. Design of a physical test protocol. A review of the ISO, INTA and UNE standards used in the industry for the characterisation of adhesives, consolidants, protectors, insulation products and supports was carried out. A selection was made of the most appropriate standards for use in the conservation field, which were linked to studies of mechanical properties, samples for physical tests, viscosity and colorimetry, among others.
3. Physical and chemical characterisation of the polymers studied, using different analytical techniques: spectroscopy, FTIR-ATR, Raman spectroscopy, GC-MS, Py-GC-MS, microscopic and technical spectrophotocolorimetric techniques in addition to mechanical tests such as traction and solubility tests (SAN ANDRÉS ET AL., 2013) (CHÉRCOLES ET AL., 2009).
4. Design of a test protocol for the accelerated ageing of polymers, defining the variables to be controlled as well as the support for the samples. The variables to be considered were: temperature, humidity and UV radiation (SAN ANDRÉS ET AL., 2011b) (SAN ANDRÉS ET AL., 2010b)
5. Finally, undertaking accelerated ageing tests on commercial products which had previously been characterized physically and chemically, in order to evaluate the behaviour of materials in the long term. The results are based on the physical and chemical characterisation of aged products and a comparative study carried out using the results of materials without ageing (SAN ANDRÉS ET AL., 2010c)



- 15 The results obtained in this research have given conservators information that is objective and of practical use. This information relates to the nature of the materials being used in this field and their long-term stability (fig.4). They have thus provided more in-depth knowledge of the behaviour of works of art and cultural heritage made from synthetic polymers, making it easier to establish the most appropriate conservation strategies..

Fig.4 Example of the information contained in the files developed in the research projects



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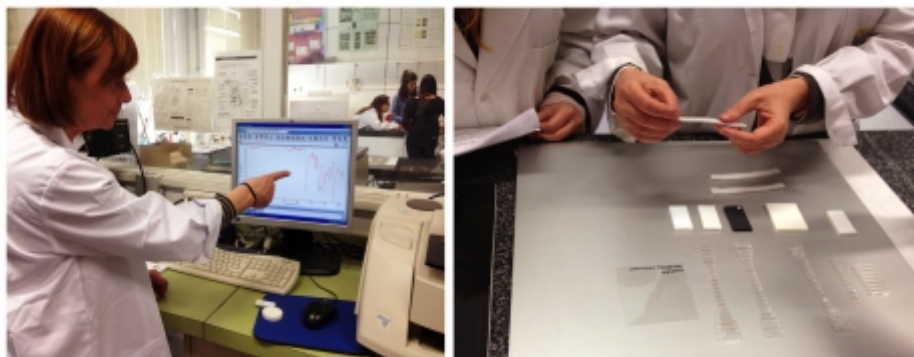
- 16 The main means of dissemination of the results is through the creation of a website (POLYEVAR<sup>1</sup>) on which the results are compiled and the behaviour, scope and limitations are shown.
- 17 The latest project, *Synthetic Polymers. New uses and benefits in the conservation of cultural heritage*, was started recently and is still on-going, and is a continuation of the line of research begun in the two previous projects. The aims of it are: (NUMBERING)

1. Increasing knowledge of the materials used in preventive conservation in packing processes, storage and exhibition of heritage works and the adhesives used in conservation. (CHÉRCOLES ET AL., 2016)
2. Studying the effectiveness of the use of different kind of polymers in dry-cleaning treatments for matte paintings and fabrics. For this study, the different products currently in the market will be analysed, and their composition, performance and the effects of their use on the properties of the treated surfaces will be identified.
3. Studying the new supports produced with synthetic materials which are currently being used as an alternative to traditional photographic media. Their composition, properties and behaviour with ageing will be studied, as well as their durability and the effects that any possible chemical changes may have on the photographic image that they support.

## Synergies between Research and Education

- 18 As would be expected, the development of all these research projects has had an obvious application in the improvement of the teaching on the Degree in Conservation of Cultural Heritage. For example, research in polymeric materials applies to teaching in the subjects that make up the Basic and Materials Science modules. These subjects include *Physics, Chemistry and Biology applied to Cultural Heritage*, taught in the second year, and *Scientific Methods of Examination and Analysis*, which is taught in the third course. (fig.5).

Fig.5 Study of the composition and deterioration of polymers



Subject *Physics, Chemistry and Biology applied to Cultural Heritage and Scientific Methods of Examination and Analysis* (second and third course).

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- 19 The syllabus of the subject *Physics, Chemistry and Biology applied to Cultural Heritage* includes a section on applied chemistry, in which the chemical reactions and factors that affect the development of a reaction are analysed, as well as the different types of chemical reactions that arise in the various materials present in heritage objects.
- 20 This section comprises the study of the main degradation reactions due to the ageing of organic materials (including polymeric ones), as well as the application of the study of the reaction of artificial accelerated ageing on the behaviour of polymeric materials in the long term.
- 21 The aim is for students to be able to link the causes of deterioration to the physical and chemical reactions caused in the material in order to address a conservation project or consider the use of new materials.
- 22 As part of the syllabus for *Scientific Examination and Analysis Methods*, the section on materials science focuses on the study of scientific methodology and experimental sciences in heritage conservation. There is also a lesson devoted to the contributions made by science to the synthesis of new materials of interest in heritage conservation (for example, polymeric materials in contemporary art and conservation of works of art).
- 23 This topic explores different types of polymers, according to their structural and technological classification, the physical properties of the polymers, the processing, the additives and fillers present, the causes of alteration and the techniques for their analysis and study.
- 24 Finally, it devotes a lesson to experimental sciences and new conservation treatments, in which the development of new materials (such as adhesives, consolidants and gels for cleaning systems) is studied, as well as the applicable methods in the field of heritage conservation resulting from scientific advances in the last century (fig.6).

**Fig.6 Practice on new conservation treatments**



New treatments with polymeric materials (gels for cleaning systems) in the subject *Scientific Methods of Examination and Analysis*.

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- 25 The aim is for students to become familiar with the polymers used in conservation, their composition, properties, use and compatibility, as well as the most appropriate analytical techniques for their study. Students will also be made aware of the functions of polymeric materials in solvent-gels cleaning systems.
- 26 Regarding the subjects of intervention on contemporary art, there are numerous applications of different projects in the subjects included in *Conservation and Restoration of Contemporary Art*. This course, which forms part of the Advanced Module taught in the third year, includes a topic on the completion of behavioural models and tests, in which students create a scale model of a contemporary work made with synthetic polymeric materials. To do this, students use original primary documentary sources and the specific bibliography to create a model with the same materials as the original work. The chosen binders include nitrocellulose and alkyd resins, acrylic solution or emulsion and vinyl resins (fig.6).
- 27 The goal of this topic is for students to be able to document a contemporary painting and faithfully reproduce its materials and techniques, in order to evaluate its behaviour. This work can thus be used to apply the different conservation treatments proposed, addressing various issues such as those raised by matte or monochrome paintings (G. FERNÁNDEZ-VILLA; LÓPEZ ; DE LA ROJA; SAN ANDRÉS, 2014)
- 28 Along similar lines, the course syllabus includes a lesson on treatments of contemporary painting, which considers surface cleaning. In this eminently practical topic, students perform various cleaning tests with the dry cleaning methods studied and analysed in research projects. The aims of this practice include an evaluation of the effectiveness of different dry cleaning materials as well as possible side effects, such as changes on the painting caused by surface rubbing. (G. FERNÁNDEZ-VILLA; DE LA ROJA; SAN ANDRÉS, 2015). This is one of the examples illustrating the synergies between education and research, as some of the cleaning practices developed in this subject have highlighted the need to specifically address the dry cleaning of matte paintings with polymer materials. This problem is being addressed in the current research project.
- 29 Finally, another of the themes of the syllabus addresses the conservation of sculptures made with plastic materials (GARCÍA FERNÁNDEZ-VILLA, 2010). In this case, the aim is to



carry out an in-depth study of the technological development of different moulding plastic materials, including semi-synthetic and synthetic plastics, and to identify the complex conservation of some of these materials, particularly nitrate and cellulose acetate, plasticised PVC and polyurethane foams (fig.7).

**Fig.7 Practice**



Student examining of a cellulose nitrate comb.

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30 The *Introduction to Preventive conservation* is taught in the third year as part of the Basic module, in Auxiliary Sources. The aim of the subject is to introduce students to the discipline of preventive conservation. The last section covers the control of these deterioration agents in exhibition and storage through the application of preventive conservation techniques, including the study of different available conservation materials, for both storage and transport (GARCÍA, 2013a).

31 It also includes the study of the properties and uses of the different polymeric materials available in the market, including films as well as packaging and archival materials. The aim of this theoretical and practical lesson is for students to learn about each of the materials and for them to be able to make a reasoned proposal for the materials used for the storage and transport of a particular piece in certain environmental conditions.

32 Finally, *Museography* is another of the subjects linked to the development of the different projects on polymers. This course is taught in the fourth year as part of the Basic module, in Auxiliary Sources. Among the tasks associated with museography, the organisation of exhibitions is considered to be one of the key functions and activities of museums. The proper presentation of heritage works will take all aspects into account in order to achieve the required balance between heritage conservation and its enhancement through public exhibition (GARCÍA, 2013b).

33 Section 5 of the subject, under the heading “Exhibition elements”, covers two specific topics in which reference is made to plastic materials due to their frequent use in exhibitions, including the materials used in the manufacture of exhibition elements, as well as display cases and supports (fig.8).

**Fig.8 Synthetic polymeric materials**



Materials studied at the subject *Museography*.

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- 34 One of the aims is for students to be aware of the constraints of conservation in the enhancement of heritage. Similarly, the idea is for students to be familiar with the most appropriate materials and techniques for use in exhibitions where the use of synthetic polymers is extremely important.

## Conclusion

- 35 As already explained, in the Degree in Conservation of Cultural Heritage, and more specifically through the research group *Documentation, preservation and conservation techniques*, the relationship between research and teaching is very relevant and in recent years has been focused on the study of new synthetic polymers. These innovative materials, available commercially for packaging or other related industries, are materials with remarkable properties and numerous uses in the field of heritage conservation. The various results obtained from the development of the competitive projects mentioned have yielded extremely relevant information on their composition, ageing and practical use, with applications in packaging and exhibitions, as well as many other uses in conservation. All these developments and the new knowledge resulting from research projects have been implemented through their practical application in subjects on the scientific examination of materials, conservation of contemporary art, preventive conservation and museography, all of which are taught on the degree in Conservation and Restoration of Cultural Heritage (UCM).
- 36 It therefore represents an example in which the benefits and synergies between teaching and research are made clear, which is particularly significant in the field of conservation of cultural heritage. Research activity thus necessarily leads to an improvement in teaching and the constant updating and renewal of teachers and students. In addition, there are some added benefits which may be generated through research work, as some of the infrastructure and equipment funded through projects are also used in teaching activities. Finally, teaching can also have a positive influence on the development of research, since it requires teachers to provide a suitable theoretical framework for the research carried-out, increasing cooperative learning. It is also a form of questioning and practical application which could make a significant improvement to the research itself.

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## Bibliographie

CHÉRCOLES, R., SAN ANDRÉS, M., DE LA ROJA, J.M. Y GÓMEZ, M.L. (2009) Analytical Characterization of Polymers used in Conservation and Restoration by ATR-FTIR. *Analytical and Bioanalytical Chemistry*, 395, p. 2082-2096.

CHÉRCOLES, R., SAN ANDRÉS, M., DE LA ROJA, J.M Y DOMÍNGUEZ, C. (2016). “Estudio comparativo de materiales comercializados bajo diferentes denominaciones pero con la misma función”.

*Actas XVII Jornada de Conservación de Arte Contemporáneo* Madrid, MNCARS.(in press)

FERNÁNDEZ-VILLA, S.; LÓPEZ REY, M.; DE LA ROJA, J.M.; SAN ANDRÉS, M. (2014) “Evaluación de sistemas de limpieza en seco sobre pinturas mates contemporáneas”. *Actas 15ª Jornada de Conservación de Arte Contemporáneo*. Madrid, MNCARS. Available at <http://eprints.sim.ucm.es/34922/1/LimpSeco-MNCARS2014.pdf>

GARCÍA FERNÁNDEZ, I. (2013a) *La Conservación Preventiva de Bienes Culturales*. Madrid, Alianza Editorial.

GARCÍA FERNÁNDEZ, I. (2013b) “Museología creativa” . *Modelo Museo. El coleccionismo en la creación contemporánea*. Granada, Universidad de Granada, p.83-98. Available at: [https://www.researchgate.net/publication/274093246\\_Museografia\\_creativa](https://www.researchgate.net/publication/274093246_Museografia_creativa)

GARCÍA FERNÁNDEZ-VILLA, S. (2010) *Los Plásticos en el Arte y el Diseño hasta 1945: Historia, Tecnología, Conservación e Identificación* (Dir.: Margarita San Andrés) [PhD Thesis]. Madrid, Universidad Complutense, Available at <http://eprints.ucm.es/11670/>

GARCÍA FERNÁNDEZ-VILLA, S.; DE LA ROJA, J.; SAN ANDRÉS, M. (2015) *Colour Change Caused by Dry Cleaning Process on Painted Surfaces*. COLOURS 2015- International Conference on Bridging Science with Art. Évora, p.38. Available at [http://www.academia.edu/16734270/RECH3\\_Book\\_of\\_Abstracts](http://www.academia.edu/16734270/RECH3_Book_of_Abstracts)

GÓMEZ, M., SAN ANDRÉS, M., CHÉRCOLES, R., DE LA ROJA, J. M., SANTOS, S., GARCÍA, P., SÁNCHEZ, J., GARCÍA, E., CEBALLOS, L., BORREGO, P. Y ÁRGERICH, I. (2011) “Revisión crítica de los materiales poliméricos en contacto con los bienes del Patrimonio Cultural”. Preprints (CD) Scientific Research Group, 16th Internacional Conference CC-ICOM. Lisboa, p. 1-10

SAN ANDRÉS, M., CHÉRCOLES, R., GÓMEZ, M.L. Y DE LA ROJA, J.M. (2010a). “Materiales sintéticos utilizados en la manipulación, exposición y almacenamiento de Obras de Arte y Bienes Culturales. Caracterización por espectroscopía FTIR-ATR”, *Actas X Jornada de Conservación de Arte Contemporáneo*, Madrid, MNCARS, p. 33-51.

SAN ANDRÉS, M.; J.M. DE LA ROJA, J. M.; CHÉRCOLES, R.; GÓMEZ, M.; BAONZA, V.G. (2010b): “Envejecimiento con radiación UV de un cartón pluma neutro. Estudio de su evolución cromática y composición”. *Óptica Pura y Aplicada*, 43 (4), p. 219-227.

SAN ANDRÉS MOYA, M., CHÉRCOLES ASENSIO, R. GÓMEZ GONZÁLEZ, M.L., DE LA ROJA DE LA ROJA, J.M. (2010c). “Factores responsables de la degradación química de polímeros. Efectos provocados por la radiación lumínica sobre algunos materiales utilizados en conservación”. *XI Jornada de Conservación de Arte Contemporáneo*. Madrid: MNCARS, p. 331 – 358.

SAN ANDRÉS, M., BLASCO, I., CALVO, A., CHÉRCOLES, R., DALMAU, C., GARCÍA, I., GARCÍA, S., MACARRÓN, A. M., DE LA ROJA, J. M., SANCHE, N., SANTOS, S. (2011a) “Caracterización Analítica, Documentación, Conservación y Restauración del Patrimonio” in *Ciencia y Tecnología para la Conservación del Patrimonio*. Sevilla, Instituto de Recursos Naturales y Agrobiología de Sevilla, CSIC, p. 83-86.


SAN ANDRÉS, M., GÓMEZ, M.L., CHÉRCOLES, R., DE LA ROJA, J.M., DEL EGIDO, M. (2011b). “Propuesta de evaluación de materiales poliméricos usados en la conservación de objetos patrimoniales”, *La Ciencia y el Arte III. Ciencias Experimentales y Conservación del Patrimonio Histórico*. Madrid: Secretaría General Técnica. Subdirección General de Publicaciones Información y Documentación. Ministerio de Cultura, p. 217-238.

SAN ANDRÉS, M., BAONZA, V.G., MONTORO, O.R., BOUZAS, A., CHÉRCOLES, R., TARAVILLO, M.Y DE LA ROJA, J. M. (2013) “Synthetic Polymers and Cultural Heritage. Analytical Approach by Raman Spectroscopy”. *Book of Abstracts 7th International Congress on the Application of Raman Spectroscopy in Art and Archeology*. RAA2013, Ljubljana, p.112-113.

## Notes

1 Available at <http://www.mecd.gob.es/cultura-mecd/areas-cultura/patrimonio/mc/polyevart/presentacion.html> (accessed June 29, 2016)

## Table des illustrations

	<b>Titre</b>	Fig.1 Structure of the Degree in Conservation and Restoration of Cultural Heritage (University Complutense de Madrid)
	<b>Légende</b>	Modules, credits and main contents.
	<b>Crédits</b>	© Degree in Conservation and Restoration of Cultural Heritage, UCM.
	<b>URL</b>	<a href="http://ceroart.revues.org/docannexe/image/5064/img-1.jpg">http://ceroart.revues.org/docannexe/image/5064/img-1.jpg</a>
	<b>Fichier</b>	image/jpeg, 2,1M

	<b>Titre</b>	Fig.2 Steps 1 to 3 of the research projects on the stability of polymers used in conservation
	<b>Légende</b>	Collaboration Project 252/2008 and Research Project CTQ2010-20831
	<b>Crédits</b>	© Research Group UCM-930420
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	<b>Titre</b>	Fig.3 Steps 4 to 6 of the research projects on the stability of polymers used in conservation
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	<b>Fichier</b>	image/jpeg, 604k
	<b>Légende</b>	Archibond® file
	<b>Crédits</b>	© Research Group UCM-930420
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	<b>Fichier</b>	image/jpeg, 620k
	<b>Titre</b>	Fig.5 Study of the composition and deterioration of polymers
	<b>Légende</b>	Subject <i>Physics, Chemistry and Biology applied to Cultural Heritage and Scientific Methods of Examination and Analysis</i> (second and third course).
	<b>Crédits</b>	© Research Group UCM-930420
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	<b>Fichier</b>	image/jpeg, 628k
	<b>Titre</b>	Fig.6 Practice on new conservation treatments
	<b>Légende</b>	New treatments with polymeric materials (gels for cleaning systems) in the subject <i>Scientific Methods of Examination and Analysis</i> .
	<b>Crédits</b>	© Research Group UCM-930420
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	<b>Fichier</b>	image/jpeg, 1,0M
	<b>Titre</b>	Fig.7 Practice
	<b>Légende</b>	Student examining of a cellulose nitrate comb.
	<b>Crédits</b>	© Silvia G. Fernández-Villa
	<b>URL</b>	<a href="http://ceroart.revues.org/docannexe/image/5064/img-7.jpg">http://ceroart.revues.org/docannexe/image/5064/img-7.jpg</a>
	<b>Fichier</b>	image/jpeg, 24k
	<b>Titre</b>	Fig.8 Synthetic polymeric materials
	<b>Légende</b>	Materials studied at the subject <i>Museography</i> .
	<b>Crédits</b>	© Isabel García Fernández
	<b>URL</b>	<a href="http://ceroart.revues.org/docannexe/image/5064/img-8.jpg">http://ceroart.revues.org/docannexe/image/5064/img-8.jpg</a>
	<b>Fichier</b>	image/jpeg, 816k

## Pour citer cet article

### Référence électronique

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