



Protection and Conservation of Artworks with Graphene

Maria Kotsidi ^{1,2}, George Gorgolis ¹ and Costas Galiotis ^{1,2#*}

¹ Department of Chemical Engineering, University of Patras, Patras, Greece.

² Institute of Chemical Engineering Sciences, Foundation for Research and Technology – Hellas (FORTH/ ICE-HT)

Presenting author: Costas Galiotis, email: c.galiotis@iceht.forth.gr

* Corresponding author: Costas Galiotis, email: c.galiotis@iceht.forth.gr

ABSTRACT

Environmental factors such as ultraviolet and visible light as well as various oxidizing agents render all works of art vulnerable to fading, yellowing and discoloration over time. These factors cause irreversible changes in the artworks with known harmful consequences for the world cultural heritage. An innovative solution based on graphene, a two-dimensional material with a thickness of one atom can contribute to the preservation and protection of pieces of art. This idea was verified experimentally through the European research project GRAPHENART ('Graphene as effective anti-fading agent for the protection of artworks', ERC-PoC, no.779985) which was coordinated by FORTH/ICEHT researchers with the participation of researchers from the University of Florence who have in the past contributed to the preservation of Renaissance paintings [1]. In this project, graphene films were developed that were used as transparent protective coatings against the degradation of the paintings. The results of the above work proved that graphene offers an innovative solution for the protection of artworks exhibited in museums and galleries, due to its special physical properties, such as the absorption of ultraviolet light, its high mechanical resistance and flexibility, its non-permeability to corrosive gases, and its hydrophobicity. In addition, this ultra-thin film adheres to any surface, while at the same time it is easy to remove. Thus, such films have been deposited in real artworks which were donated to FORTH/ICEHT by the painter Matina Stavropoulou. The results were very encouraging and after experiments with accelerated aging, it turned out that the use of graphene can double the life time of these precious crafts. In fact, these results were recently published in the prestigious scientific journal with a high impact factor, Nature Nanotechnology ("Preventing color fading in artworks with graphene veils", 2021) [2]. The above activities have been granted a patent by the Hellenic Industrial Property Organisation (HIPO) entitled as "Protection of artworks using two-dimensional materials such as graphene" (no. 1009757). At the same time, through a patent financing program of 'the Bodossakis Foundation', a patent application has been submitted to the European Patent Office (no. PCT/EP2019/085993).

REFERENCES

- [1] P. Baglioni, E. Carretti, and D. Chelazzi. 2015. , *Nat. Publ. Gr.*, 10:287–290.
- [2] M. Kotsidi et al. 2021. *Nat. Nanotechnol.*, 16:1004-1010.