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Nanostructures and layer stacking in artistic materials: the origin of colors in paintings

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Materials science today provides us with a vision of the processes involved in the creation of a work of art, from the choice of materials to the visual perception of the finished work.
The precious character of the paintings of the old Masters and their uniqueness imply particular cautions and require instruments, which may give the maximum of information directly on the surface of the objects, in-situ in the museums or in the archaeological sites. The implementation of new analytical tools, including various spectroscopies, allows a deep insight on the artistic materials. We will first show applications of different mobile instruments we built recently in the laboratory.
We will then showcase how Cadmium sulfide pigments may assume different hues from yellow to orange, depending on their conditions of formation. During the 19th century, various synthetic routes for CdS nanoparticles synthesis were explored to produce pigments for artists, precipitating cadmium salts with sulfur precursors. Several factors are involved in the colorimetric values of the CdS: structural defects, polymorphism in the crystal lattice and nanometric size of the crystallites. This complexity has postponed the supply of these pigments to the artists for more than 20 years after the discovery of cadmium in 1817. The light-stability of these pigments is also related to the nanometric crystallite size and the degree of crystallinity that has been improved by thermal treatment.

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