

Revealing Chemical Processes in Oil Paintings

Old master paintings as well as modern and contemporary art are subjected to changes from the moment they have been made. Discoloration, increased transparency and darkening, chalking, delamination and losses: these are just some alteration phenomena encountered in paintings. These phenomena affect the appearance and stability of paintings and as a consequence the conservation is faced with various conservation challenges. Furthermore, material changes can lead to art historical misinterpretations and it is important to predict their future behaviour to define optimal exhibition and storage conditions for preventative conservation. To address the conservation and preservation challenges, full characterisation of the painting and its alteration phenomena, fundamental studies into the aging mechanisms and driving forces behind the alteration processes is crucial.

In the museum, paintings and their alteration products are investigated at a macro-, microscopic and molecular level. The fast development of non-destructive imaging techniques, such as macroscopic X-ray fluorescence scanning, hyperspectral imaging and macroscopic X-ray powder diffraction scanning, makes it possible to generate detailed chemical maps of the paintings. Micro-sample investigations provide information about the paint composition at a micro- and molecular level including the layer stratigraphy of the painting. As paintings are eminently heterogeneous, multi-component objects and samples are precious and limited, the conventional analytical techniques are challenged. As most paint samples require high spatial resolution and high sensitivity, synchrotron-based techniques provide a good solution.

The outcomes of the macro- and microscopic techniques form the basis for fundamental chemical studies performed in academic laboratories. Quantitative and qualitative spectroscopic and spectrometric studies on smart designed oil paint model systems provide a detailed understanding about the mechanisms and driving force of migration of paint components through paint layers.

The insights gained with microscopic analytical studies on real paint samples combined with quantitative studies on paint model samples will be discussed in this presentation.