MS43-2-3 Insight into thermally-induced reduction of Plattnerite into red lead pigment
#MS43-2-3

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Abstract
Red lead, mixed valence state lead oxide (Pb3O4), is a bright red pigment particularly appreciated and widely used since antiquities. In mural paintings this pigment may darken due to the degradation to plattnerite (b-PbO2), which is a brown-black pigment. Up to now, no well-established conversion methods to restore darkened red lead in wall paintings have been reported. In this context, the thermally induced lead dioxide conversion into red lead can bring about new insights. In fact, in recent research the thermal effect of Near Infrared (NIR) Continuous Wave (CW) laser irradiation has been exploited and tested on mural painting mock-ups [1].
However, the apparent contradictory results reported in the literature concerning the decomposition of lead dioxide [2-4] is a strong hint for the dependence of the new lead oxide formation on temperature, heating rate and duration of the heat treatment. The formation of non-stoichiometric lead oxides as intermediate species in the plattnerite conversion has, to the best of our knowledge, not been monitored by a close analysis of the crystalline phases. Therefore, a detailed analysis of the suitable heating conditions is required to define an efficient thermal conversion method.
In the present work, a high-temperature X-ray diffraction study has been carried out on plattnerite powder samples with different temperature, heating rates, quenching or annealing and environment conditions. Each crystalline phase was then characterized by micro-Raman spectroscopy allowing the identification of specific spectral features of intermediate non-stoichiometric lead oxides. The combination of X-ray diffraction pattern with the corresponding Raman spectrum of the same crystalline phase allowed to shed light on the laser induced degradation mechanism that occur during irradiation of plattnerite with NIR CW lasers.

References
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