

Additional file 1

Table S1 – List of the main semiconductor and mineral pigments that can be found in modern paintings. For every pigment is reported (i) the general name, (ii) the chemical formula and the crystal structure, (iii) the band gap energy in eV (and the corresponding wavelength /nm) known from literature. (iv) and (v) report the near-band-edge (NBE) and trap state (TS) wavelength emission under near UV excitation, respectively. (vi) the origin of trap state emission as found in literature.

	Pigment name	Chemical formula (typical crystal structure)	Band Gap energy (eV/nm)	NBE emission (nm)	TS emission (nm)	Origin of TS
Semiconductor pigments	Zinc white ¹	ZnO (hex)	3.4 eV / 365 nm	380 nm	500÷550 nm	Intrinsic defects (vacancies)
	Cadmium Light Yellow ²	Zn _x Cd _{1-x} S (hex)	2.63÷2.44 eV / 470÷510 nm*	470÷510 nm	700÷750 nm 800÷1000 nm	Intrinsic defects (surface vacancies)
	Cadmium Yellow ²	CdS (hex)	2.42 eV / 510 nm	510 nm	800 nm	Intrinsic defects (surface vacancies)
	Cadmium Red ²	CdS _{1-x} Se _x (hex)	2.26÷1.97 eV / 550÷630 nm**	550÷630 nm	800÷900 nm 108÷1100 nm	Intrinsic defects (surface vacancies)
	Titanium white, Rutile ³	TiO ₂ (tetr)	3.0 eV / 410 nm	400 nm	800 nm	Intrinsic defects (vacancies)
	Titanium white, Anatase ³	TiO ₂ (tetr)	3.2 eV / 387 nm	500 nm	-	-
Mineral pigments	Barite	BaSO ₄ (ort)	4.0 eV / 310 nm	450 nm	-	-
	Calcite	CaCO ₃ (hex)	5.1 eV / 240 nm	450 nm	600 nm	substitutional ions (Mg ²⁺)
	Egyptian Blue ⁴	CaCuSi ₄ O ₁₀ (tetr)	2.0 eV / 620 nm	-	910 nm	substitutional ions (Cu ²⁺)
	Cerussite ⁵	PbCO ₃ (ort)	6.2 eV / 200 nm	-	500÷550 nm	Intrinsic defects (vacancies)
	Hydrocerussite ⁵	2PbCO ₃ ·Pb(OH) ₂ (tri)	6.2 eV / 200 nm	-	480÷580 nm	Intrinsic defects (vacancies)

* depending on the zinc content in the binary solid solution: the higher the zinc content, the higher the Band Gap energy.

** depending on the selenium content in the binary solid solution: the higher the selenium content, the lower the Band Gap energy.

¹ Artesani et al. *Materials* **2017**, 10 (4). DOI:10.3390/ma10040340

² Cesaratto et al. *Analytical Methods* **2014**, 6 (1). DOI: 10.1039/c3ay41585f

³ Van Driel et al. *Dyes and Pigments* **2018**, 155. DOI: 10.1016/j.dyepig.2018.03.012

⁴ Comelli et al. *Heritage Science* **2016** 4:21. DOI : 10.1186/s40494-016-0090-5

⁵ Gonzalez et al. *Analytical Chemistry* **2017**, 89 (5) DOI: 10.1021/acs.analchem.6b04195

Raman Spectrum

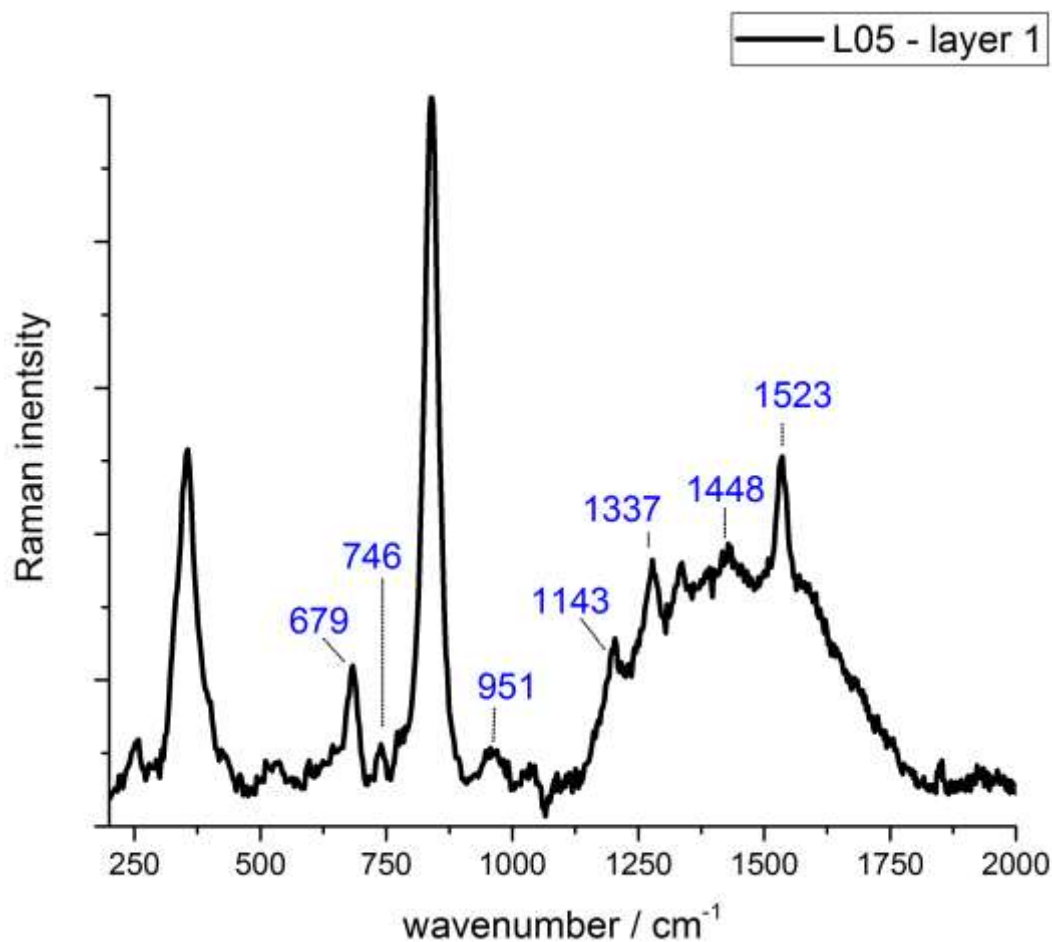


Figure S1 - Raman spectrum of Layer 1 in sample L5 detected with the grating 600 lpmm in the spectral range 200-2000 cm⁻¹. It shows the presence Lead chromate (354(s-br), 375(sh-m), 839(vs)) and Phthalocyanine Blue. Blue numbers highlights the Raman bands used for the identification of Phthalocyanine blue (256(m), 679(s), 746(s) 951(m), 1143(m), 1337(s), 1448(m), 1523(vs)).