Accurate non-invasive analyses of paintings’ primings – is it possible?

Miroslaw Wachowiak
1) Department of Conservation and Restoration of Modern Art, Fine Arts Faculty, Nicolaus Copernicus University, Center for Research and Conservation of Cultural Heritage, Torun, Poland

miroszwach@umk.pl

The composition and structure of primings especially in the case of commercially available, ready made primed supports after preliminary research proved to be an important tool broadening dating and authentication of the 19th century paintings. The materials differ in time as producers were exchanging or broadening the range of used fillers and admixtures, following availability of the sources and lowering prices of materials. The composition of grounds can be the characteristic indicator of time of execution and sometimes of attribution as are pigments. Yet the problem was the invasiveness of the analyses and necessity of the sampling.

Novel attitude toward the use of XRF and execution of FTIR equipped with movable light transmitting arm ATR probe enables new non-invasive approach of the primings research, broadening its possibilities.

Conducted research proved possibility of indicating changes of primings in the subsequent periods of the 19th. c. Non-invasive recognition of basic composition even of the two layers grounds was possible. Gypsum and chalk problematic to distinguish with XRF could be differentiated even when mixed together using FTIR-ATR. Lithopone is hardly to be indicated as it is hardly visible in XRF, its presence suggests use of former one. Panorama of evolution of chemical composition of grounds in the researched period will support dating of the Polish 19th century paintings. Data gained with XRF portable spectrometry was complemented with SEM-EDX confirming accuracy of the XRF analyses.

Non invasive examination of two layered grounds by XRF

XRF measurements conducted from the backside of the painting and from top of the priming present on the tacking margins allowed recognition of structure and elemental composition of the two-layered grounds.

Limits assessment measurements conducted on model samples

XRF spectra of two kinds of pure gypsum and one with chalk admixture (green line spectrum).

Comparison of gypsum (light and dark green line spectrum) and different kinds of chalk, which contain no sulfur.

Raising amount of Ca and fall of S of mixtures of gypsum and chalk in ratios: 2:1 3:1 Ca peak gradually decreasing, S peak hidden by L-lines of Pb ions.

Comparison of mixtures of lead white and gypsum in ratios: 1:1 3:1 Barium peak visible as is sulfur.

Zinc sulphide – no Ba containing high amount of S, lithopone – Ba peak visible as is sulfur.

Barium sulphate – Ba high peak, S hardly visible.

Mixture of zinc white with barium sulphate compared to zinc sulphide – in preceding mixture S hardly visible.

Zinc sulphide – highest amount of S, lithopone 60 – significant amount of S little amounts of.

Lithopone 30 – barium sulphate identified and more clearly visible.

Lithopone containing original historical priming – barium sulphate identified – no zinc sulphide visible.

Conducted research proved possibility of indicating changes of primings in the subsequent periods of the 19th. c. Non-invasive recognition of basic composition even of the two layers grounds was possible. Gypsum and chalk problematic to distinguish with XRF could be differentiated even when mixed together using FTIR-ATR. Lithopone is hardly to be indicated directly, yet as S in BaSO₄ is hardly visible in XRF, its presence suggests use of former one. Panorama of evolution of chemical composition of grounds in the researched period will support dating of the Polish 19th century paintings. Data gained with XRF portable spectrometry was complemented with SEM-EDX confirming accuracy of the XRF analyses.

Author would like to acknowledge National Centre of Science, Poland for funding project 2012/05/D/HS2/03385 entitled New pigments of the 19th century.