

## MODERN METHODS OF CONSOLIDATING AND REINTEGRATING OLD PAINTINGS

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PhD Thesis Abstract

The first intervention in restoring an object of cultural heritage made from wood consists of consolidating various detachments of the pictural layers of the panel. This intervention is performed with natural or synthetic binders, involving specific operations. The current technological and industrial progress generated several new products and innovative methods, which are not used for preserving and restoring the objects of cultural heritage. Classical methods and materials are still used in restoring sites and workshops, which have several disadvantages. Therefore, *the present paper aims at studying the behavior of classical and commercial binders, involved in consolidation of the damaged pictural layer of old wood paintings*. One of the goals of these studies was to build an effective, practical and cheap consolidation system.

### Goals:

- *Bibliographic analysis and synthesis* of the current state of knowledge of the operations prior to restoring and museal valuing of the old wood paintings (preventive/final consolidation and consolidation methods);
- Selecting new materials for consolidation and reintegration of old paintings, based on *a field and laboratory work protocol regarding their composition, adhesion capacity, in correlation with the period, technique, materials, and the degree of decay of the components of the analyzed paintings*.
- Designing *experimental protocols concerning the consolidation of old paintings* with complex casuistry of the preservation state, which need urgent intervention for highly accurate and effective consolidation. Within this protocol, we initially selected several old icons or fragments from state and private collections, which were taken into custody during the period of the analyses.
- Designing *three experimental protocols concerning the aging of the materials applied on samples* painted on wood, under the action of temperature, hygroscopic humidity, and UV radiations.
- Establishing *relations of complementarity* among various *analysis techniques* in order to achieve *an experimental protocol with multiple applications* for the study of the *chemical nature*

and physical-structural features of the analyzed pictural materials, binders and pelliculogenes, as well as the assessment of their behavior in time, after application.

- Studying the impact of the new materials for consolidation and reintegration of old wood paintings;
- Writing scientific papers and disseminating their results by publishing or participating to national and international scientific events.

Taking these aspects into consideration, the present paper aims at an interdisciplinary approach of the goals related to revealing the destruction and alteration of old paintings; typological classification of the effects of deterioration and decay of the pictural layer; selecting materials and studying their behavior after consolidation operations, as well as comparative presentation of the results of artificial aging of the classical and new binders.

Out of the elements that bring novelty and originality to this PhD thesis, we mention:

- Designing *experimental* and *analytic protocols* in order to achieve the purpose of the PhD thesis in optimal conditions, which asked for a systematic research of consolidation materials and methods, with important results for valuing old paintings with poor preservation state;
- Analysis and optimization of physical-chemical system and effective methods for ceasing the progressive decay of the old paintings;
- Assessing compatibility and efficiency of these applications, by using three artificial aging methods;
- Equating the time of accelerated aging by exposing to temperature, hygroscopic humidity and UV radiations with the time of natural aging of the applied materials, respectively adhesives and commercial pelliculogenes with various technological functions (fish glue, rabbit-skin glue, acrylic binder BINDER type, wood adhesive D3 type, adhesive for laminate parquet and wood WOODFIX D3 type, acrylic resin ACRIL 33 type, silicone resin, binder, impregnant NANO PRO C type, and impregnant NANO PRO M type);
- Assessing the impact of consolidation operations using the analyzed pelliculogenes on the original colors of the paintings;
- Assessing the effectiveness of consolidation operations with adhesives and pelliculogenes on fissures, cracks and dynamic detachments;
- Building simple, effective, practical and cheap consolidation systems, affordable for restorers;
- Disseminating results by publishing scientific papers and participating to national and international symposia.

To reach its purpose, the present thesis contains twelve chapters, structured in two parts: *theoretical part* and *experimental part*.

***The first part, the theoretical one (critical analysis and bibliographic synthesis of the current state of knowledge)***, is spread over three chapters and it is meant to introduce the readers in the theme.

In **chapter I**, we presented the typology of wood paintings, structural components and materials involved in artwork, as well as the synergic action of the microclimate factors, abiotic and biotic agents, directly responsible for the decay which is frequently met in old paintings. These degradations and damages were presented in detail in **Chapter II**, as casuistry, classified depending on the pictural components as identified, nature, shape, structural morphology, but also on exogenous and endogenous causes. Ending the theoretical part (Chapter III), we presented a history of materials and methods that were used to consolidate the pictural materials, together with a few aspects related to the natural aging of these materials.

***The second part*** is spread over eight chapters, plus the general conclusions and it contains the *personal contributions* concerning the actual research, with field and laboratory work protocols, as well as the experimental results:

- MO and SEM-EDX analysis of classical and new materials for consolidation and completion of the damaged pictural material;
- Accelerated aging of the analyzed classical and new binders for 272 hours, on samples of painted wood, at temperature, hygroscopic humidity and UV radiation. This period is equivalent to a natural aging of one year for temperature and UV radiation;
- Accelerated aging of the analyzed classical and new binders for 344 hours, on samples of painted wood, at temperature, hygroscopic humidity and UV radiation. This period is equivalent to a natural aging of ten years, for temperature and UV radiation;
- Consolidating the damaged pictural layer with acrylic binder (BINDER);
- Influence of the acrylic consolidant BINDER on gildings with gold and schlagmetal;
- Studying the behavior of puttying and consolidation of the damaged pictural layer;
- Studying consolidation processes by using a spray gun and a nebulizer with a compressor, Omron type;
- The experimental results were subject of 13 published scientific papers (ANNEX I), out of which 6 as a first author, as follows: 2 international ISI, 2 national ISI, 1 international BDI, 4 national BDI, and 4 in volumes with ISBN, as well as 13 presentations at various

international scientific events (5) and national scientific events (8). It is important to remember that some of those 13 published papers are cited 3 times: 3 in ISI journals and 2 self-citations in ISI journals.

As a consequence of all experimental results, considering the fact that variations  $\Delta E^*$  until 5 units, registered on the artificially aged samples, are considered as insignificant by ICE Commission, we can state that all the new binders, adhesives and impregnants, used in all performed experiments (acrylic binder, BINDER type; adhesive for wood, D3 type; adhesive for laminate parquet and wood, WODFIX Super D3 type; silicone resin, ACRISIL 201 type; acrylic resin, ACROSIL 201 type, consolidant, REXIL type; impregnant for porous surfaces and wood, NANO PRO C type, impregnant for protection of marble, NANO PRO M type), age slower than the classical ones (5% and 8 % fish glue, 5% and 8% rabbit-skin glue) and they can be successfully used to consolidate the damaged pictural layer.

During the artificial aging of the samples, under the action of the three microclimate factors, the detachments initially consolidated, by forming pellicle with the analyzed new materials, adhered to the panel, keeping their cohesion during and after the artificial aging, except for the samples that were skinned with NANO Pro C and Nano Pro M impregnants, which do not have adhesive properties.

As a consequence of the results and experimental data regarding the time resistance of Nano Pro C impregnant and of the waterproofing it provides to the artifacts, we recommend using this impregnant in preserving the wood paintings.

Out of the analyzed commercial adhesives and consolidants, the best results of the artificial aging under the action of temperature, hygroscopic humidity and UV radiations had the samples that were consolidated with Rexil, acrylic binder (BINDER) and Acrisil 2012.

The two analyzed adhesives (Adhesive for wood, D3 type, and Adhesive for laminate parquet and wood, WODFIX Super D3), together with the acrylic binder (Binder) have a lower penetration capacity, compared with the other analyzed commercial materials.

Based on the experiments regarding assessing the impact of the systems for consolidating the damaged pictural layer, by using the spray gun and nebulization with a device like Omron, one may conclude that we recommend using the consolidation system by spraying with a spray gun as effective, practical, simple, cheap, easy to handle, and affordable for all restorers.