INNOVATION IN WOODWORKING INDUSTRY AND ENGINEERING DESIGN, 1/2013 (3): 111–117

METHODS OF FORMING COATS WITH ANTIQUE EFFECT

Panayot Panayotov[1], Jivko Georgiev[2], Diana Nikolova[3]
University of Forestry, 10 Kliment Ohridski blvd, 1756 Sofia, Bulgaria
[1]e-mail: ppanayotov@yahoo.com, [2]jivko_v_g@abv.bg
[3]diana_nikolova@yahoo.com

ABSTRACT

Methods of finishing for creating antique effects were analyzed. It was established that to create these finishes - chemical stains, patina powder, sealer and top-coats are used. It is easy and quick to achieve these effects, when they are formed on tannin-containing wood. It is established that antique effects can be coated on wood which doesn't contain tannin (Spruce, Scots Pine), if the effects are made by suitable stains, paints and top-coats. It was made technologies for making „multicolored chestnut", „antique paint" and „crackle" effects on chestnut and ash wood. These special effects are in use in modern fluency in furniture with antique effects. The most important qualities were explored.

Key words: wood, chemical stains, old finishes, furniture with antique effect

INTRODUCTION

The modern progress in technologies is allowing us to create more comfortable interior with new, qualitative materials. It was made an analysis about modern influence in furniture sale. There were demarcated two basic directions: „the new", characterized with extremely clear lines; sharp lines; straight corners; maximum simple, practical design and the „the old" – nostalgia back to the past: rounded shapes; delicate colors; floral motives [4]. More and more people are interested in this style: our dynamic lifestyle is making us to turn back to the calmness, to the home comfort, which physically can be felt with the furniture .Furniture, which looks old, but has the same quality and character as the new one. It was made with false impression of antiquity with effects, made by different forming coatings [2, 3]. The analysis was made and it was established that the most common effects are used for creating antique effects: effect „old paint", effect „crackle" and effect „white pores" [3,4]. These effects can be made with completely technologies methods, in following the technical order. It doesn't eliminate hand work, for example cleaning the corners with soft pressure with sandpaper [9]. This is an example, showing that the technology order of operation and the duration are very important. It should be conformable with the materials, which are used and the technologies of forming for maximum stage of reiteration and to avoid defects.

MATERIALS AND WORK EXPERIMENTAL METHODS

Chestnut wood (*Castanea sativa)* and ash wood (*Fraxinus excelsior L*.) were chosen for making furniture with antique effects. They were chosen because they belong to the hardwood and their wood has a similar structure, but the containing of extractives is different. The same effects, made on ash wood and chestnut wood looks different. There were made samples of ash (index F) and chestnut (index C) with the following sizes 8x50x300 mm and furniture aggregate (furniture doors) for visual effects with sizes 25x200x360 mm. There were made measuring of the mass in liquid state and dry state for calculating the expense and

coverless. The fat coat was determinate in following equation:

$$\delta_{c\phi} = \frac{P.c}{100.\rho}, [\mu m] \quad \textbf{(1)}$$

where:

P – coating expense, [g/m^2]

c – dry containing, [%]

ρ – coating density, [kg/l]

There were used the following materials for creating antique effects: sodium bicarbonate ($NaHCO_3$), potassium dichromate ($Cr_2K_2O_7$); ferric three chloride ($FeCl_3$); acrylate coatings: Paneli assa; AU 468; AZ 9930 and PVA glue „Tutkal massiv“. Sodium bicarbonate ($NaHCO_3$) is hard white substance. The water solution of natrium bicarbonate is alkaline (salt made by strong alkali and soft acid). Potassium dichromate ($Cr_2K_2O_7$) is orange-red crystals or plates with density 2,69 g/cm^3. It made a soft digest solution (130 g/l). It doesn't digest in ethyl alcohol. Its water solution has an orange-red color and soft acid character. The pH rate is (100 g/l H_2O) 3,75. Ferric three chloride ($FeCl_3$) is hard, dark crystals, which change its color in dark green to purple lilac-red depending on the light. It has a soft odor; the density is 2,898 g/cm^3. The water digest is 92 g/100 ml, the acetone digest is 63 g/100 ml, it is very digest in methanol and diethyl ether. Paneli assa is water borne acrylate varnish, made by company Tikkurila-Finland. The coverless vary from 8 to 12 m^2/l. Dry time: 30 min for touchable, 2–3 h for next layer, completely dry after 2 weeks. Dry containing is 22 %, the density is 1,01 kg/l (ISO 2811). AU 468 is water borne sealer, made by company Sayerlack-Italy. The coverless is form 80 to 140 g/m^2. AZ 9930 is water borne acrylate white paint, made by company Sayerlack-Italy. Tutkal massive is PVA glue, made by company Dyo-Turkey.

These materials were chosen to make next three effects, which are provisionally called: effect „antique paint“, effect „crackle“ and effect „multicolored chestnut“. The samples are indexed as following: effect „antique paint“ (index A) – FA and CA; effect „crackle“ (index C) – FC and CC; effect „multicolored chestnut“ (index M) – FM and CM.

Effect „Antique paint“ was made following the next order: sanding the surface with sandpaper 180; painting a thin layer with water borne sealer AU 468; after 1 h painting with solution of water borne white paint AZ 9930/BB, sodium bicarbonate and water in proportion 3:1:1; after 4 h drying is medial sanding with sandpaper 240 and soft pressure to "scrub" the paint, specially the corners; next operation is cleaning the dust and painting with water borne varnish Panelli assa.

Effect „Crackle“ is made following the order: sanding the surface with sandpaper 180, painting with thin layer water borne sealer AU 468; after 1 h is putted PVA glue, class D3 Tutkal Massif; after 10 min drying period is painted with water borne white paint AZ 9930/BB; after 3 min drying the samples are applied to speeded drying to tear the white coating; painting with water borne varnish Paneli assa.

Effect "multicolored chestnut" is made in following order: sanding the surface with sandpaper 180; staining with 10 % solution of potassium dichromate and ferric three chloride (1:1) in water; after 40 min is painted with 25 % solution of organic based stain XM 7100/13 in acetone; after 15min is sanding with sandpaper 180; staining with staining with 10 % solution of potassium dichromate and ferric three chloride (1:1) in water; staining with water borne stain AU 468; after 4 h is medial sanding with sand-

paper 320 and painted with water borne varnish Paneli assa.

To measure the quality of the formed coatings with antique effects the adhesion was measured. The adhesion was measured using the method of wresting metal stamp and it was determinate the vision of destruction [1; 2; 3]. After completely drying of the varnish, the samples have been conditioned in indoor conditions and the metal stamps are glued to the surface with cyanogen acrylate glue Locktite, made by Loctite-Ireland in license of Henkel-Germany. After 72h is determinate the power of wresting on universal examine machine FU – 1000 using the aggregate, showed on figure 1. The adhesion was calculated on the equation (2):

$$\sigma = 0{,}032.F, \left[N/mm^2\right] \quad \textbf{(2)}$$

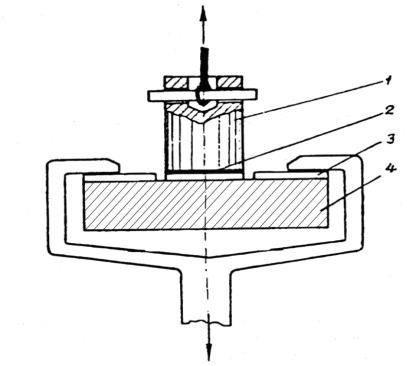

Figure 1: Aggregate for determinate the adhesion of formed coating to the wood: 1-metal stamp; 2 – coating; 3 – final coating; 4 -

RESULTS AND DISCUSSION

The measurements are showed in tables. The used products and their solutions are additionally analyzed and the measured results are showed in table 1. It is obviously that the dry contain of the materials vary from 20 to 80 %; the thickness of the formed coating vary from 10 μm to 100 μm. In table 2 are showed medial arithmetic values of the adhesion. It is obviously the adhesion has a low value and it can be explained with the mechanical treatment in forming the effects (scrubbing, wiping) and the desired incompatibility between different compositions, used for different layers. For making these effects, the materials were used with different chemical composition. It should be marked the measured adhesion is sufficient. The low values in effect „crackle“ can be explained with the use of glue, in effect „antique paint“ – with medial sanding before painting with the varnish, where the paint is almost rubbed to the wood; in effect „multicolored chestnut“ – with the solution, which is stain.

Table 1: Description of the materials, which were used for creating the effects

Material	Dry containing, [%]	Density, [kg/l]	Viscosity DIN 4, [s]
Paneli assa	22	1,01	15
AU 468	30	1,02	18
AZ 9930 BB	30	1,19	20
Solution AZ 9930 BB and sodium bicarbonate in water (3:1:1)	19	0,93	14
Tutkal massiv	80	1,15	90
10 % water solution of $Cr_2K_2O_7$ and $FeCl_3$	10	0,95	10

Table 2: Adhesion and description of the destruction

Series	Low bound σ_a [N/mm^2]	Upper bound σa [N/mm2]	$\bar{X}$	S_x	V_x	m_x	P_x	Prevalent character of destruction [%]
CA	1,76	2,88	2.333	0.382	16.399	0.110	4.734	90 AWS
CC	1,6	2,72	2.160	0.370	17.155	0.106	4.952	90 AWS
CM	0,96	1,60	1.106	0.186	16.836	0.053	4.860	80 ASV
FA	1.92	3.36	2.250	0.444	19.734	0.111	4.933	90 AWS
FC	1,60	2,72	2.080	0.391	18.842	0.097	4.710	85 AWS
FM	0,96	1,44	1.170	0.208	17.808	0.052	4.452	90 ASV

Description: CA – effect „antique paint“ on ash samples; CC – effect „crackle“ on ash samples, CM – effect „multicolored chestnut“ on ash samples; FA – affect „antique paint“ on chestnut samples; FC – effect „crackle“ on chestnut samples, FM – effect „multicolored chestnut“ on chestnut samples; X – medial arithmetic value; S_x – standard; V_x- factor of variation; m_x - medial blunder; P_x – factor of accuracy; AWS – adhesion wood-stain; ASV – adhesion stain-varnish.

Prevalent destruction on effect „antique paint“ (index CA and FA) is between the wood and the stain. It can explain with the order of the effect, in some spots the paint is almost erased and the wood can be seen. In effect „multicolored chestnut“ (index CM and FM) the destructions are between the stain and the varnish, which can be explained with the fact the solution of the stain soak in the wood. The vision of the destruction is shown on figure 2, figure 3, and figure 4.

Figure 2: Destruction in effect „multicolored chestnut“ made on chestnut “CM”

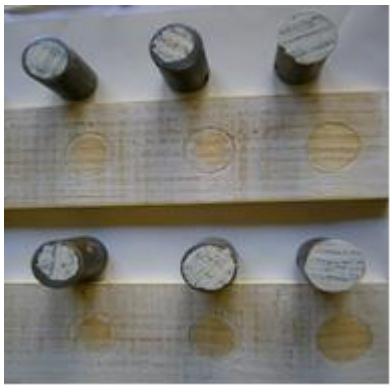

Figure 3: Destruction in effect „Antique paint: made on ash „FA“

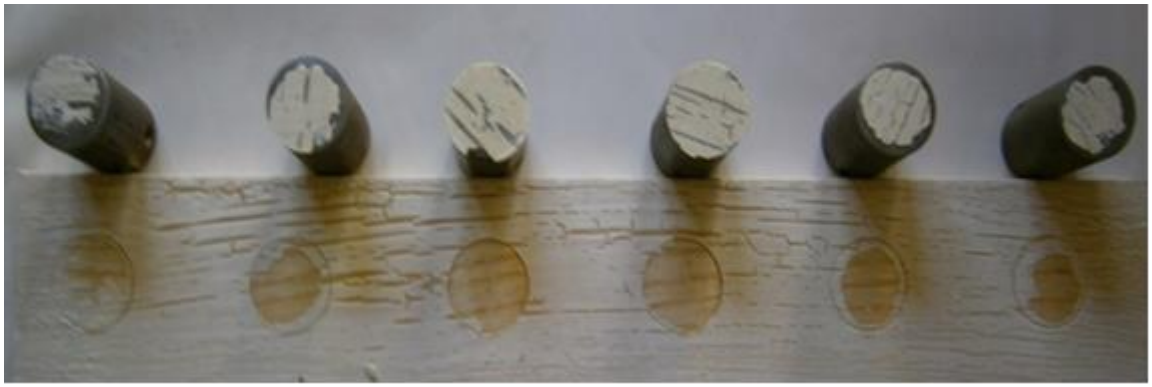

Figure 4: Destruction on effect „crackle“ made on ash „FC“

Effect “antique paint” made on ash is shown on figure 5, on chestnut – on figure 6; on furniture aggregate (furniture door) – on figure 7.

Figure 5: Effect „antique paint“ on ash

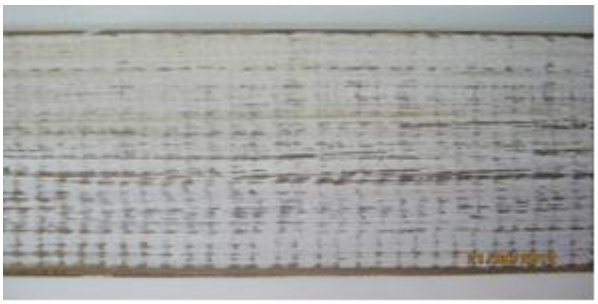

Figure 6: Effect „antique paint“ on chestnut

Figure 7: Effect „antique paint“ on furniture aggregate (furniture door)

Effect „crackle“ made on ash is shown on figure 8, on chestnut – on figure 9; on furniture aggregate (furniture door) – on figure 10.

Figure 8: Effect „crackle“ on ash

Figure 9: Effect „crackle“ on chestnut

Figure 10: Effect „crackle“ on furniture aggregate (furniture door)

Effect „multicolored chestnut“ made on ash is shown on figure 11, on chestnut – on figure 12; on furniture aggregate (furniture door) – on figure 13 and figure 14.

Figure 11: Effect „multicolored chestnut“ on ash

Figure 12: Effect „multicolored chestnut“ on chestnut

Figure 13: Effect „multicolored chestnut“ on furniture aggregate (furniture door) made by ash

Figure 13: Effect „multicolored chestnut“ on furniture aggregate (furniture door) made by chestnut

CONCLUSION

The created coatings show variants for making effects, imparting antique effects on the furniture. Their technology guaranties their multiplicity repeat. For making effect „multicolored chestnut“ and effect „antique paint“ the thickness of the coating is on advisable limit, so it is recommended painting with two layers of varnish. Effect „multicolored chestnut“ is made using the reaction between tannins in chestnut to the ferric chloride and potassium dichromate. The variety of colors is improved by use of white dye and that’s make the effect more interesting. The adhesion has low values, but it was

expected. Created effects are modern and sale prospecting.

REFERENCES

1. BNS EN ISO 4624: 2004. ICS 87.040.
2. Panayotov, P. (2012), Glues and matherials for protective-decorative finishies; Publishing house of University of Forestry-Sofia, 2012, p. 331, ISBN 978-954-332-091-2
3. Panayotov, P. (2008), Materials and processes of forming protective-decorative finishies; Publishing house of University of Forestry – Sofia, 2008, p. 289, ISBN 978-985-332-055-4
4. Soderberg, G., "Finishing Technology", 1983; USA; Library of Congress, card catalog number: 72 – 86470
5. Patination, magazine "Design-materials-technologies", 2007, 1, 88–89. www.dmt magazine.info
6. Artificial aging of wood, magazine "Design-materials-technologies", 2007, 1, 88–89. www.dmtmagazine.info
7. www.tikkurila.com
8. www.sayerlack.it
9. www.youtube.com.