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Investigations upon some properties of surfaces of wood based materials finished with decorative foils in continuous technology

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Abstract: *Investigations upon some properties of surfaces of wood based materials finished with decorative foils in continuous technology.* The aim of the work was the qualification of chosen utylity properties of surfaces wood-based materials finished with foils CPL in continuous technology in industrial conditions. Particleboard (thickness 4 mm) and HDF (3 mm) were used as a substrates for veneering.. For experiments four PVAC adhesives in D3 glue lines durability class and 4 finishing materials (3 decorative PVC foils and 1 CPL) were used. The ivestigations contained selection of lamination parameters across the qualification of influence of the thermal aging cycles on the course of aesthetic-decorative features, and resistance on some utylity factors. It was stated among others, that thermal aging did not influence into the essential matter into gloss changes, and resistance of finishings to cold liquid action. Finishings showed differential resistance on the influence of the UV radiation.

Keywords: wood based material, foil, CPL, finishing, adhesive, property, gloss, UV radiation, cold liquid action

INTRODUCTION

Special attention needs to be put on the technology of surface laminating by the end product manufacturer, since this branch of industry is developing fast empowering the production of relative cheap wares, with reproducible decors, much differentiated design, able to be competitive with traditional finishings in aesthetics. For laminating of board elements natural veneers, artificial foils or paper impregnated with synthetic resins were applied (Proszyk 1999). This materials are manufactured by pressing together a certain number of paper layers (HPL and CPL) impregnated by adequate resins depending on the using purpose. The surfaces is being printed by decors imitating wood or another material and in the end lacquered. The laminates surfaces are very durable for mechanical-, thermal- and chemical factors. Finish foils are also paper carrier, but they are made from only one layer, what makes them very thin and lets use besides flat surfaces also for laminating profiled elements (Proszyk 1999, Oniśko 2001, Soiné 2001). The veneers on synthetic carrier are first of all in form PVC, and PE or ABS foils too. These materials are characterized with high moisture durability allowing using them as the finishing of kitchen and bath furniture (Krzoska-Adamczak 2001). On all foils, either on the paper or artificial carrier, a special surface structure can be made by embossing. (Dunky and Niemz 2002,Oniśko 2002, Anonymous 2003, 2005, Zeppenfeld and Grunwald 2005).

The aim of this work was to determination of selected properties of wood based materials finished with decorative foils and CPL in continuous technology in industrial conditions.

EXPERIMENTS

Board elements were finished in industrial scale in STOLBUD WŁOSZCZOWA Comp. For experiments four PVAC adhesives (fulfilling D3 class acc. to PN-EN 204 standard) and 4 finishing materials (3 finish foils and 1 CPL) were used. Particleboard (thickness 4 mm) and HDF board (3 mm) were used as a substrates.

Aesthetic-decorative features (gloss with photoelectrical method) and investigations of resistance of finished surfaces on chosen chemical (cold liquids action acc. to PN-EN 12720 standard) and light UV-VIS (UV radiation acc. to PN-88/F-06100/08 standard) factors were executed. Properties of finishing materials in function of number of cycles of changing temperatures (acc. to PN-88/F-06100/07 standard (A method) properly after number of 3, 6 and 9 cycles) were performed. In the Table 1 schematic marking of materials prepared for experiments were presented. On the basis of results of first stage of experiments parameters of veneering procces were fixed (Krystofiak, Lis and Proszyk 2011).

Evaluating the aesthetic-decorative properties across gloss measurements using photoelectric apparatus PICO GLOSS 503 was performed, allowing the three-angular (20°, 60°, 85°) investigations of the gloss degree.

The resistance of surface to liquids action was determined with chemical test described in PN-EN 12720 standard and with the use of a 5 degree results scale. Surfaces of samples were tested for the resistance to cold liquids action (solvents: acetone, thinner for polyurethane, nitrocellulose thinner, petroleum naphtha and other liquids: „Kiwi" /shoe polish/, „Ludwik" /dish wash/, „Pronto" /wood emulsion/, „Sidolux" /universal cleaning wash/ and water after 1, 6 and 24 h action time.

Table 1. Schematic marking of materials applied for experiments

Materials / Adhesive	1 - „alder" (foil)	2 - „cherry" (foil)	3 - „white" (foil)	4 - „nut" (laminate)
1 - Henkel Comp.	Schematic marking: XYZ: X – Substrate (1-HDF board, 2-Particleboard) Y – Foil/Laminate Z – Adhesive			
2 - Dural Comp.				
3 - Synthos Comp.				
4 - Jowat Comp.				

Investigations of the resistance of finishings to UV radiation was led acc. to PN-88/F-06100/07 standard.

RESULTS

In Table 2 the course of gloss changes with standard deviation (SD), after thermal aging cycles was presented. Investigations of resistance of tested finishings upon UV radiation was modified, because after 1 h of the influence did not ascertain no matter which changes of color of the surfaces. In Table 3 results of resistance of finishings to UV radiation was presented.

In Table 4 resistances on cold liquids action of investigated foils formed on HDF substrate were taken down. Thermal aging cycles caused no change of the resistance of the foils, in the same way used PVAC adhesives. Instead it was stated that essential influence of the substrates. For example the 111 variant showed the entire resistance on all applied liquids, except the shoe polish Kiwi, while the 211 variant (differing only with the substrate) only during the liquids action at 1 h equaled the of 111 variant. In all remaining cases on the surface were observed distinctly changes. In parley with the substrate from the particleboard were observed the distinctly relief of the surface structure, what in parley with the substrate with HDF board did not have the place even at long times of the action of given liquid. Used to research solvents caused no change within the range times of the action of 2 min - 24 h.

Table 2. The course of gloss changes of finishings vs. number of thermal aging cycles

Kind of foils (acc. to Table 1)	Number of cycles	Gloss											
		Along direction						Across direction					
		20°		60°		85°		20°		60°		85°	
		Value	SD	Value	SD	Value	SD	Value	SD	Value	SD	Value	SD
1	0	1.5	0.1	12.7	0.3	18.9	0.6	1.5	0.1	12.9	0.2	18.6	0.4
	3	1.5	0.1	12.5	0.4	19.0	1.0	1.5	0.1	12.8	0.3	19.1	0.8
	6	1.5	0.1	12.7	0.4	19.8	1.0	1.5	0.1	12.7	0.3	19.7	0.7
	9	1.5	0.1	12.7	0.3	20.3	0.7	1.5	0.1	12.5	0.3	19.6	0.5
2	0	1.4	0.1	13.0	0.1	33.2	0.9	1.4	0.1	13.3	0.1	32.3	1.1
	3	1.3	0.1	13.1	0.1	33.8	0.8	1.4	0.1	13.5	0.2	33.9	1.1
	6	1.3	0.1	13.4	0.1	34.3	0.9	1.3	0.1	13.5	0.2	33.7	1.0
	9	1.4	0.1	13.4	0.1	33.9	0.8	1.4	0.1	13.6	0.2	34.5	1.0
3	0	2.8	0.1	17.2	0.1	47.8	0.5	2.8	0.1	17.4	0.5	48.9	0.4
	3	2.8	0.1	18.0	0.4	51.7	0.7	2.8	0.1	17.9	0.3	51.9	0.6
	6	2.8	0.1	18.1	0.9	50.0	1.2	2.8	0.1	17.0	0.7	49.3	0.6
	9	2.8	0.1	17.6	0.5	51.5	1.4	2.8	0.1	17.8	0.6	50.8	1.2
4	0	2.6	0.1	17.6	0.4	21.8	0.6	2.7	0.1	17.8	0.5	20.9	0.5
	3	2.4	0.1	16.7	0.6	22.0	0.4	2.6	0.1	17.5	0.6	21.3	0.6
	6	2.6	0.4	18.1	2.4	22.0	2.8	2.8	0.4	18.4	2.8	21.6	3.8
	9	2.4	0.1	16.7	0.5	22.5	0.6	2.4	0.1	16.9	0.6	21.4	0.8

Table 3. Resistance of finishings to UV radiation action

Resistance	Marking of foils (acc. to Table 1)			
	1	2	3	4
Time, whereby changes were observed [h]	4	1	3	2

Table 4. Resistance of finishings on selected cold liquids action

Liquids	Action time [h]	Marking of variants (acc. to Table 1)															
		111	112	113	114	121	122	123	124	131	132	133	134	141	142	143	144
		Note (scale acc. to PN-EN 12720 standard)															
„SIDOLUX”	24	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
„PRONTO”	24	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
„KIWI”	24	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5
	1	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5
	6	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5
„LUDWIK”	24	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Water	24	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

CONCLUSIONS

On the basis of carried out experiments it was stated, that:

1. Tested finishing materials were characterized with high and stabile aesthetic-decorative features. Thermal aging cycles did not influenced into gloss changes.
2. Finishings showed differential resistance on the influence of the UV radiation. In respect of the resistance can it draw up (from greatest to least):
   No 1 (alder foil) > No 3 (white foil) > No 4 (CPL) > No 2 (cherry foil)
3. Influence (even 24 h) of solvents on tested finishings did not cause no matter which damages of the surface. Not large changes after the use of chosen liquids from the group of economic chemistry (especially "KIWI") were observed. Thermal aging cycles did not influence into the essential matter in relays of the resistance of finishings of cold liquids action.

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Streszczenie: *Badania wybranych własciwości powierzchni tworzyw drewnopochodnych uszlachetnionych dekoracyjnymi foliami w technologii cągłej*. Celem pracy było określenie wybranych własciwości użytkowych powierzchni tworzyw drenwopochodnych uszlachetnionych dekoracyjnymi foliami w technologii ciągłej w warunkach przemysłowych. Do realizacji eksperymentów w charakterze podłoży użyto płytę wiorową (grubośc 4 mm) oraz HDF (3 mm). Zastosowano 4 kleje PVAC w klasie odporności spoin D3 oraz 4 materiały do uszlachetniania powierzchni (3 dekoracyjne folie PVC oraz 1 laminat CPL). W procesie oklejania zmieniano parametry procesu badając następnie wpływ starzenia termicznego uszlachetnionych elementów płytowych na kształtowanie się ich walorow estetyczno-dekoracyjnych, odporności na promieniowanie UV oraz oddziaływanie zimnych płynów. Na podstawie rezultatów preprowadzonych eksperymentów, m.in. sstwierdzono, że testowane powierzchnie charakteryzowały się wysokimi walorami estetyczno-dekoracyjnymi, stabilnymi w warunkach starzenia termicznego. Uszlachetnione powierzchnie wykazały zróżnicowaną odporność na oddziaływanie promieniowania UV. Starzenie termiczne nie obniżało odporności powierzchni na zimne płyny.

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