THE INFLUENCE OF CHOSEN FACTORS ON PLASTICITY OF WOOD SURFACE

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Abstract

This paper deals with the problematic of pressing – relieve of poplar wood surface. We were searching the influence of wood moisture, depth of relief (impression), stabilization and direction of wood fibers. Detected characteristics were the change of relief depth and its final size, quality of relief surface and the shape of relief profile.

Key words: *pressing, relieve, surface quality, shape of the wedge, shaping stability*

INTRODUCTION

Relieve is a decorative modification of wood surface by pressing, the purpose of this is rising of decorative facilities of wood by the change of surface shape. By this style of wood surface modification we can achieve different geometric pattern, pattern of wood structure, ornamental elements… There is also possible to apply this modification on almost all materials surfaces on wood basis. Suitable for relieve can be for example veneer, solid timber, laminated wood, veneer on primer material.

METHODICS OF WORK

The ground for the achievement of target ware experimental works. Their basis rests in monitoring of manipulated parameters (moisture, depth of depress, stabilization and direction of wood fibers) on relief created by pressing tool. Searched and judged characteristic ware:
- the change of relief depth (impression) and its final size,
- quality (roughness) of relief surface (impression),
- the shape of relief profile.

For the purpose of moisture influence searching ware the test specimens made from poplar wood with measurements 120x120x15mm, divided in two basic groups, and that with moisture 7% (average 7,4%) and 14% (average 14,22%). Each of these groups was divided into subgroups, and that on surface treated by moistening (wetted for 3 min) and without any adjusting, than the group was divided into basic files (each by 10 samples) for pressing without stabilization and pressing with stabilization (by effect for 3min).

The first judged characteristic was the change of relief depth (impression) and its final size. The experiment consisted of following parts:

1. Reduction of heated pressing roller (temperature 150˚C) with diameter 35 mm into three different depths (3, 5 and 7 mm) vertically on the fibers (fig. 1).
2. Depth scanning with timing gauge (in time periods „0_{min}, 2_{min}, 5_{min}, 10_{min}, 30_{min}, 1_h, 2_h, 4_h, 8_h, 24_h, 48_h") by the scheme visible on fig. 2.
3. Graphical visible of process of depth change and calculation of its residual size according to relation (1):

$$h_z = h_p - h_8 \quad [mm] \tag{1}$$

where: h_z – residual relief depth [mm],

h_p – thickness of climatized sample before the reduction [mm],

h_8 – thickness of sample after 48 hours from wedge releasing [mm],
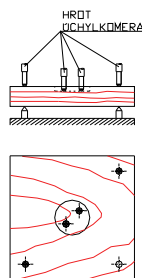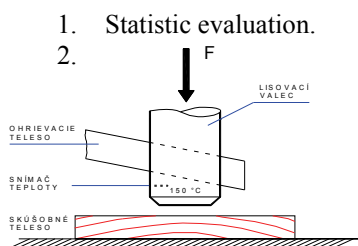
1. Statistic evaluation.
2.

Fig.1 Releasing of pressing roller into the test specimen by timing gauge   Fig. 2 Scanning of relief depth (impression)

The second judged characteristic was the quality of relief surface (impression) determinated after releasing of heated roller and wedge (with 45˚ peak) on the temperature 150˚C. We detected the surface quality by:

1. Roughness measuring (roughmeasure instrument type: POCKET SURF III from company MAHR), detected value: Ra (middle arithmetical variation of judged profile)
2. Visual: by means of loupe – according to size of cracks we ranged raw surfaces in to quality classes.

The instruments (roller, wedge) ware released in depth 3, 5 and 7 mm. On the by roller released surface (fig. 3a) we evaluated the surface roughness before and after pressing in cross and lengthwise direction. We evaluated the surface released by wedge (fig. 3b) visual and by roughness measuring. The wedge was released into the tangential face in three different directions (parallel to the fibers, vertically to fibers angle-wise 45°) (fig.4).
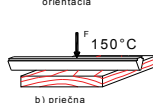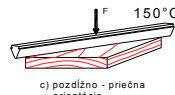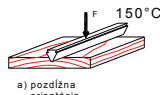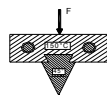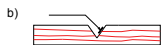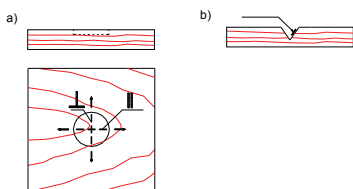

Fig. 3 The areas of detected face roughness on the surface **a)** after roller releasing   Fig. 4 The wedge and its orientation to the fibers **b)** after wedge releasing

We evaluated the measured results graphic and by multifactor statistic analysis.
The third judged characteristic was the shape of relief profile. We judged this visual by comparing the ideal shape (shape of wedge used for relief) and the real shape impression, obtained after pressing (fig. 5).
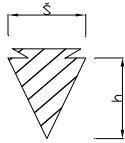
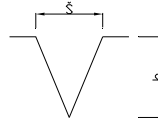The shape of relief wedge   Ideal relief shape

Fig. 5 The shape of relief wedge and ideal relief shape

RESULTS AND DISCUSSION

We evaluated the relief depth (impression) after roller releasing in dependence on wood moisture, its modification (not modified, modified by moistening) and stabilization (without and stabilized). Following the measured (fig. 5) and evaluated results we can pronounce following conclusions:

**Test specimens with 7% initial moisture:**
- moistening in cooperation with stabilization affects positive the relief depth,
- moistening without stabilization has a negative impact on the relief depth (by this file of test specimens we achieve negative results).

Test specimens with 14% initial moisture:
- moistening has shown like a negative factor (relief depth decreased against samples not modified).

Following the files comparing of test specimens with initial moisture 7 and 14% we can state:
- by relieve is the 14% moisture preferable than 7% moisture,
- the relief depth by samples with initial moisture 7% modified by moistening is coming close to the depth by wood moisture 14%,
- stabilization has shown in all cases like a positive modification effecting on the relief depth.
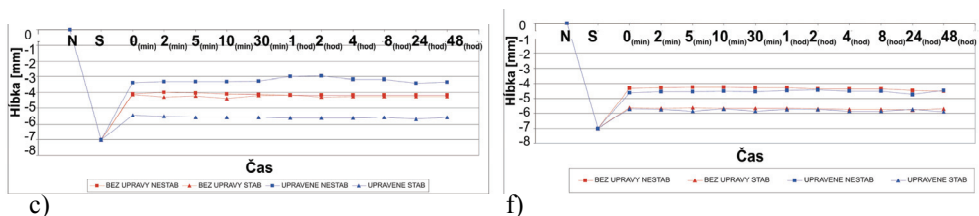
c)

f)
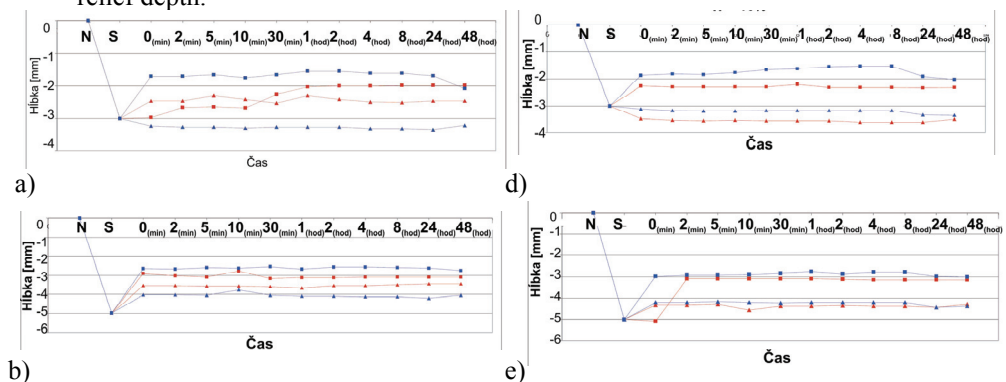
Fig. 5 Process of relief depth change created by roller:
a), b), c) – wood moisture 7%
d), e), f) – wood moisture 14%

From the results of wood surface roughness before and after pressing detected on by roller released surface we can state (fig. 6):

- roughness in direction parallel with fibers is less than in direction vertically to the fibers,
- the roughness of surface decrease by pressing,
- degree of compression has a small influence on the surface quality,
- by moistening increase the surface roughness (the surface quality deteriorate),
- stabilization decrease the surface roughness (the surface quality improve),
- moisture (7%, 14% - without moistening) basically doesn't influence the surface roughness.
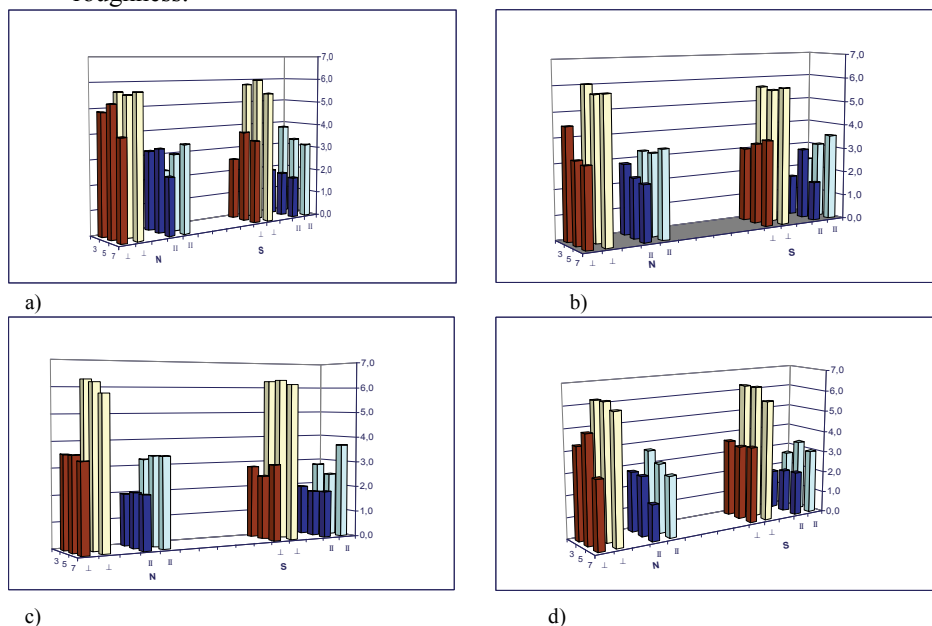

a)

b)

c)

d)

Fig. 6 a, b, c, d: Roughness of samples surface [μm] in dependence on moisture, fibers direction, modification (moistening), and stabilization (before and after pressing). (Marking: roughness before pressing, roughness after pressing, N – samples without stabilization, S – stabilized samples, II – roughness in fibers direction, ⊥ - roughness in direction vertically on the fibers)
a) 7% moisture, without modification (moistening),
b) 7% moisture, moisten samples,
c) 14% moisture, without modification (moistening),
d) 14% moisture, moisten samples.

The wood surface quality after relieve (pressing) achieved by printing the wedge with 45° we evaluated visual. Following the measured and judged results we can state:

- the surface quality is declines with increasing of released depth,
- the best quality was achieved by wood moisture 14% (without moistening) and 7% with moistening,
- the positive influence of stabilization has shown,
- in different direction of wedge effect there is a different failure of wood.

Following the visual reviewing of relief shape after pressing we come to cognition, that this is changing in dependence on direction of wedge impressing, in relation to wood fibers direction. The shape change has shown markedly by larger depths of releasing (5;7 mm). Typical shapes after pressing of wedge shows fig. 7. Different shapes are consequence of different wood deformations in its anatomic directions.
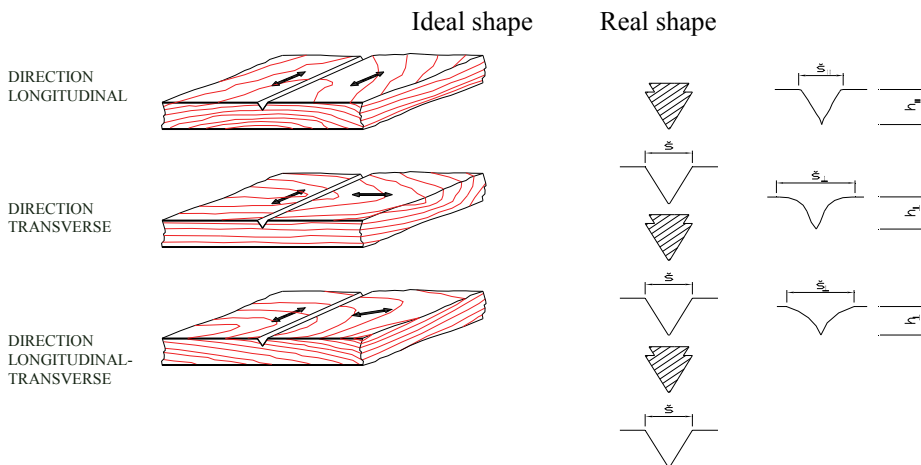
Fig.7 The shapes of obtained relief in dependence on wood fibers direction

CONCLUSION

In this paper we deals with the influence of chosen factors on the plasticity (relieve) of wood surface. Detected and judged characteristics of relief ware the change of relief depth (impression), the shape of relief profile.

The results of experimental exams has shown, that for the relief depth is 14% moisture preferable than 7% moisture. In all falls has shown the positive influence of stabilization in process of pressing – i.e. the effect of pressure after relief creating in pressing process. Moistening in cooperation with stabilization has a positive influence on relief depth by 7% moisture of wood; by 14% moisture there was no markedly proof of its influence.

On the contrary, without stabilization has the moistening rather negative effect on the relief depth.

By roughness valuation detected on roller released surface has the pressing shown like a factor positive influencing the surface quality, especially in cooperation with stabilization. The wood moisture and relief depth has a small influence on surface depth change.

By valuation of shape of profile we come to knowing that the relief shape profile is changing in dependence on direction of wedge press in relation to wood fibers direction. The change of this shape has shown markedly by major depth of releasing (5;7 mm).

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