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Investigations upon roughness of particleboard surfaces after manual sanding

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Abstract: *Investigations upon roughness of particleboard surfaces after manual sanding.* The effect of the kind of the abradant in chosen abrasive papers in the operation of the manual sanding on the formation of parameters of the roughness of the particleboards was studied. Abrasive papers based on the abradant in properly form of Al_2O_3 and SiC materials at the various degree of the granulation. As sanding device, was applied the pneumatic out-of-centre grinder, the rotary type. Measurement of the roughness of particleboards carried out with the use modified Carl Zeiss AG ME-10 apparatus. Altogether was designated 7 parameters of the surface roughness. As basic parameters subjected then to the analysis was chose sizes: Rz, Ra, Rp and Rv. It was stated among others, that simultaneously differentiating effects superficial particleboards turned out the parameter Rz. Remaining parameters placed themselves for individual variants on the close level of the value. Abrasive papers on Al_2O_3 or SiC basis used for the manual sanding of the particleboard did not exert the fundamental influence on the quality of obtained surfaces.

Keywords: particleboard, abrasive paper, manual sanding, surface, roughness parameter

INTRODUCTION

Particleboards are applied in a wide way especially in furniture and building industry, and also in various interior equipment. In large uses wide- and narrow surfaces are subjected to veneering with natural veneers or artificial materials on the paper base, and also finished with synthetic foils or laminated. Furthermore in some uses the particleboards surfaces are finished with lacquer products. In above context, wood and particleboards quality too are evaluated by surface roughness (Peters, Cumming 1970, Richter et al. 1995, Sandak, Tanaka 2003, Bekhta, Marutzky 2007, Bekhta et al. *in press*). Sanding processing of the particleboards surface in industry conditions are carry out in solutions of all sorts and kinds technological, usually in "on line" arrangement (Miron 2012, Kubalt 2013, Wroński 2013).

Some part of offered particleboards, finds individual purchasers to the production first of all various furniture and the domestic equipment, usually within the framework of providing or the modernization of buildings or others applied. In these application of the particleboards surface processing it behaves very often in extemporaneous conditions, in the manual way (Pszczołowski, Rosienkiewicz 1995). The analysis of literature data proves, that until now one did not publish works dedicate to this problem In cooperation with one of known producer of abrasive papers were carry out relevant investigations in the model-seizure with the use of newly elaborated abrasive materials on the basis of Al_2O_3 and SiC (Woźniak 1982).

The aim of work was the recognition of the influence of the kind of the abradant in chosen abrasive papers in the operation of the manual sanding on the formation of parameters of the surface roughness of particleboard.

MATERIALS AND METHODS

For the realization of the experiments one applied the three-layered particleboard P2 type according to PN EN 312:2011 standard. The board was bought in the random way in the

warehouse of construction materials. She was characterized with the following technical data: MC=7.9%, the density ρ = 580 kg/m^3, the bending strength 11 MPa, the module of the elasticity at the inflexion 1600 MPa, the strength on the stratification $\perp$ 0.35 MPa. The board was air-conditioned (20/60) in time 336 h. After that one prepared samples at dimensions 250x200x18 mm which were subjected to the manual sanding process. Abrasive materials was chosen (from the assortment of the HERMES Comp.), in the form of self-adhesive disks at the diameter 150 mm. Abrasive papers based on the abradant in form properly: Al_2O_3 and SiC at the various degree of the granulation, determined with the numeration suitably P80 (212 - 180 μm) and P180 (90-75μm). As sanding device, was applied the pneumatic out-of-centre grinder, the rotary type (HERMES Comp.), about following technical data:

- working pressure 0.63 MPa
- rotations of the plate 1200 r.p.m.
- jump of the plate 5 mm
- air consumption 170 dm^3/h.

Samples for the sanding processing were fastened to the working table with special crushes. For the purpose of the elimination of vibrations, the table additionally was charged with sandbags about the total mass approx. 200 kg. On the basis of preliminary results of experiments was accepted following constant parameters of the sanding process of particleboards:

- the clamp of the grinder to worked surface with the mass 1.7 kg, attached to the corps of the grinder
- during the processing the grinder was carry out manually accordingly with the mechanism of the work of the grinder (the movement oscillatorily - rotary) and in the manual (the movement amblingly - returnable) way, the working time carried out 15 s. After the end of the sanding operation surfaces carefully was cleaned from the dust with compressed air, then was proceed measurement of the surface roughness.

Profile surface was recorded using a modified Carl Zeiss AG ME-10 profile gauging profilometer, equipped with a stylus a radius of 2 μm and apex angle of 90^o. Feed speed during profile recording was set at 100 μm/s. Recorded data were filtered according to the standards PN-EN ISO 11562:1998, and PN-EN ISO 13565-1:1999. The following parameters of particleboard surface roughness were evaluated: R_a, R_z, R_q, R_p, R_v, R_{sk}, and R_{ku}. R_a is arithmetic mean of absolute departures of the roughness profile from the mean line. R_q is the square root of the arithmetic mean of squares of original values. R_p is the maximum height of the profile above the mean line within sampling length. R_v is the maximum depth of the profile below the mean line within sampling length. $R_z = R_p + R_v$ and it is the maximum peak to valley height within sampling length. Skewness (R_{sk}) is a measure of symmetry of the profile about the mean line. Kurtosis (R_{ku}) is a measure of randomness of height and the surface sharpness.

RESULTS

In Table 1 one put together obtained results of investigations of chosen parameters of the surface particleboard roughness. Analyzing registered values, it was stated compatible with expectations results, expressing dependences among two variants of taken into account in the work of the numeration of abrasive papers. From among taken into account in the evaluation of the surface roughness of parameters, most sensitive, simultaneously differentiating in the way most perceptible registered superficial effects of particleboard turned out the size R_z. The surface of the particleboard not processed with the sanding showed the roughness expressed with the parameter R_z on the level 40 μm. In effect carried out sanding process was found the express restriction of this parameter. Regardless of the kind of the abradant, at the processing

with the paper P180 to valley obtained values little exceeding 14 μm. However for the paper P80 concerning data placed themselves on the level 22 μm.

This means therefore that parameters of the surface roughness of particleboard, obtained with the use of papers about the numeration P180, were characterized in the relative seizure with P80, with the clearly superior quality. Remaining analysed parameters of the roughness did not show noticeable differences, being shaped for considered variants on moderately the close level of the value. In case of the differentiated kind of the abradant, obtained values in the equality circuit did not show significant differences.

Tab. 1 Results of investigations of the parameters of particleboard surface roughness with the regard of individual variants of abrasive material

Roughness parameter	Type of abrasive papers			
	Al_2O_3 - P80	SiC - P80	Al_2O_3 - P180	SiC - P180
	[μm]			
R_z	21.52	21.53	14.11	14.37
R_a	3.97	3.80	2.68	2.41
R_p	12.96	13.18	8.32	7.66
R_v	8.56	8.35	5.79	6.71

In the comment to these data it can find, that the use of the Al_2O_3 or SiC for of manual sanding of the particleboard, does not exert the fundamental influence on the quality of obtained surfaces. In turn analysing the look of the abrasive paper during carry out sanding process, was observed for individual variants the differentiated degree of his silting. It was stated, that the abrasive paper on the basis of SiC about the numeration P180 in processes of the abrasive working had caused considerable silting of the work surface, what be effective can with more intensive getting worn out the tool. Probably can this be caused a cleavage of this abradant, what in this case one can acknowledge as the fault of this material. In turn the use of material with the abradant on the basis of Al_2O_3, caused that the degree of silting in the comparative seizure turned out decidedly smaller. His characteristic features, such as the high hardness, at the practically low inclination to the cleavage, prefers this material as clearly better from the point of view of requirements of the processing.

However in case of abrasive grains about the numeration P80, both the abradant on the basis of Al_2O_3 or SiC, was characterized with the analogous preservation of material during the sanding, what was effective lower in rank of silting. During realizing of experiences, did not find any differences among taken into account in the work with abradants. This constatation concerns also the way and the intensity of the manual conduction of the grinding device in the process of the working of the particleboard surface.

CONCLUSIONS

1. In the process of the manual sanding of the particleboard with the use of different abrasive papers it was stated what follows. From among analysed in investigations of the parameters Rz, Ra, Rp and Rv of taken into account in the evaluation of the surface roughness of the chipboard, most sensitive and simultaneously differentiating effects superficial particleboards turned out the parameter Rz. Remaining parameters placed themselves for individual variants on the close level of the value.
2. Applied abrasive papers on the Al_2O_3 or SiC basis used for manual sanding of the particleboard did not exert the fundamental influence on the quality of obtained surfaces.
3. Abrasive paper P180 on the basis of the SiC in processes of sanding of particleboard express silted the working surface of abrasive material.

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Streszczenie: *Badania chropowatości powierzchni płyt wiórowych szlifowanych manualnie*. Badano wpływ rodzaju ścierniwa w postaci Al_2O_3 oraz SiC w wybranych papierach ściernych na kształtowanie się parametrów chropowatości powierzchni płyty wiórowej w operacji manualnego szlifowania powierzchni płyty wiórowej. W charakterze urządzenia obróbczego, zastosowano szlifierkę pneumatyczną mimośrodową, typu rotacyjnego. Pomiary chropowatości przeprowadzono zmodyfikowanym profilografometrem Carl Zeiss ME-10. Aparat wyposażony był w końcówkę pomiarową o promieniu zaokrąglenia 10 mm i kącie wierzchołkowym 90^o. Pomiary wykonywano na odcinku pomiarowym 50 mm z prędkością 100 μm/s. Na podstawie rezultatów przeprowadzonych badań, m.in. stwierdzono, że spośród rejestrowanych wielkości charakteryzujących efekty powierzchniowe płyty wiórowej poddanej manualnej obróbce szlifowaniem z zastosowaniem szlifierki oscylacyjno-rotacyjnej najbardziej różnicującym efekty struktury geometrycznej okazał się parametr Rz. Zastosowanie w tej operacji papierów ściernych na bazie odpowiednio Al_2O_3 lub SiC, nie wywarło zasadniczego wpływu na jakość uzyskiwanych powierzchni. Papier ścierny P180 na bazie SiC, w procesach manualnego szlifowania płyty wiórowej wyraźnie zamulał obrabianą powierzchnię płyty.

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