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Comparative Researches on the Roughness of Sanded Wooden Surfaces with Wide Belt and Abrasive Brushes

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Abstract

The paper presents comparative results of experimental researches on roughness parameters Rk and Rpk to sanding surfaces with wide belt and abrasive brush at the beech wood (Fagus sylvatica L.). The purpose of the research was to demonstrate that the sanding surfaces with abrasive brushes, offers the same surface quality, as wide belt sanding surfaces, where dusting and refinishing sanding operations were also conducted. The results lead to the optimization of sanding technology.

Keywords: wood; sanding; roughness; brush; wide belt

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Nomenclature

n	revolution speed
u	feed speed (similarly with f)
Rk	parameter that assesses the processing roughness
Rpk	parameter that assesses the raised fibres of wood
Hci	height of initial contact
Mv	revolution electromotor
Mu	feed electromotor
h	wood height
AlO	Aluminium Oxide
SiC	Silicon Carbide

1. Introduction

Wide belt sanding technique has to be effected in several steps, starting with an abrasive article with a coarser particles ending with abrasive articles with finer particles. These results from the relationship associated between the cut rate and the surface finish [6]. By sanding with wide belts applying these well-known techniques to the sanding of wooden articles severe problems have been observed when trying to create a particularly smooth surface with a roughness value below 2 μm, the abrasive particles tend to be loaded rather quickly so that in industrial application is not possible to utilize the finer materials, the sanding is especially limited to the grit sizes P180 or P220. What is observed is that with these finer grit sizes the abraded material from the wooden articles comprising fibres cannot be removed from the abrasive article or belt, it stays between the individual abrasive particles and inhibits further abrasion. The result is a non-free cutting abrasive and increased frictional forces [8]. Another problem is that the sanded wooden pieces show a significant number of loose fibres, these fibres are typically 10-50 μm in length and they are the cause for the following problem: these fibres are essentially loose when the surface is coated with lacquer. They tend to lift up and cause protrusions in the lacquer layer, especially if this is thin enough so that either a thicker layer of lacquer is needed or an additional sanding operation [4].

In the last 15 years in the wood processing industry appeared a new product the sanding brush [4], as a consequence of necessity to improve the obtained sanded surfaces and for achieving less consumption of coating materials and better finishing results. The innovative sanding method based on the principles of sanding which fundamentally is different to the traditional methods. Instead of sanding by applying a constant pressure on the surface the sanding with abrasive brushes is based on the principle by which the aggressive sanding is accomplished by the speed of the revolving tool [7].

Thus, sanding brushes became a common tool used for sanding the wooden surfaces after wide belt sanding, and tending to eliminate the necessity of hand sanding of the wooden products.

In the industrial practice, the sanding of wooden surfaces with brushes is performed to eliminate the microfibers formed during sanding with wide belts [7]. Most producers of abrasives brushes propose sanding of raw wood materials after wide belts with the same grit size or with a greater level, thus with grits equal or greater with P150, P180, P220, as after this grits is usually applied the coating materials [4],[9].

The conducted research was made on the beech wood (Fagus sylvatica L.). Wooden samples were sanded with abrasive brushes using different feed speed and revolving speed using grit sizes of P150, P180 and P220 of two different abrasive types Silicon Carbide and Aluminium Oxide. Further were investigated the roughness using Mitutoyo Surftest SJ-201 equipment using a stylus detector. The results conducted to high quality surfaces obtained by brush sanding in comparison with the wide belts, the roughness parameters being 10 times smaller, and by sanding with Silicon Carbide can be achieved a smaller roughness.

2. Objectives

The main aim of the experimental study presented in this paper was to determine the correlation between the grit of the abrasive brush and the roughness of the sanded wooden surface, as well as to compare the results with the surface roughness obtained after sanding with wide belts.The roughness parameters analyzed in this paper are Rk - Core roughness depth (parameter that assesses the processing roughness) and Rpk - mean height of the peaks protruding from the roughness core profile[11], (parameter that assesses the raised fibers of wood) according to SR EN ISO 13565-2:1999, as recommended by the [2],[10].

3. Method, materials and equipment

The material used within the present research consisted of radial timber specimens, as shown in the Fig. 1., cut from the same beech (Fagus sylvatica L.) log, being one of the most common wood material used in furniture industry [5].The moisture content of the specimens after drying, determined by means of a Pin-Free moisture-meter was 10-12%.

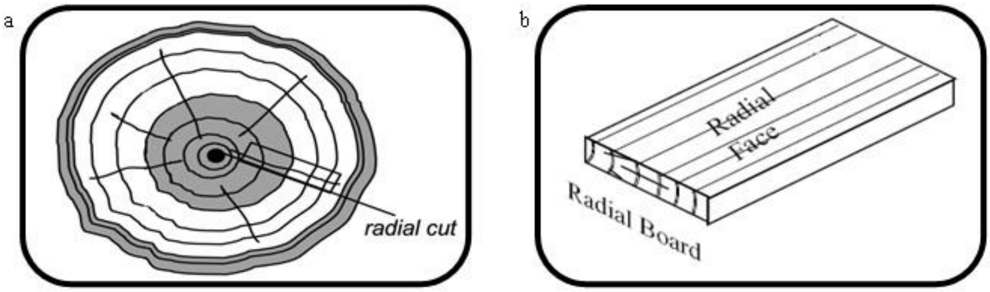

Fig. 1. (a) top view of a wooden log with the marked lines representing the timber board; (b) timber board with its faces.

Initially all the boards were sanded with wide belt at a speed of the belt 18m/s, while the feed speed was 4.5 m/min, done in several passes with an abrasive paper grit P80+P120+P150.One third of the parts were then put apart, while the other samples were sanded in a single pass with an abrasive paper grit of P180.Out of these, the samples were placed apart hereinafter, while the remaining samples were sanded with abrasive paper grit P220.

Each wooden board was trimmed into parts of approximately equal sizes (Length x Width x Thickness) (185 x 50 x 18 mm), so a total of 120 samples was obtained.

The samples which were sanded with wide belt of grit size P150 were further sanded with abrasive brush of the grit P150, the other samples sanded with wide belt of grit P180 were sanded with brush of the grit of P180 and the ones sanded with wide belt of grit P220 were sanded with brush of grit P220.

The sanding with brushes was performed on an experimental stand composed from a belt conveyor table driven by an electric motor developing a feed speed between 3 and 6 m/min, and the cutting tool attached to an electric motor positioned on an height adjustable stand, the sanding brush having a rotation speed between 450 and 700 rpm. In the Fig. 2. (a) is the representation of the experimental stand, and in the Fig. 2. (b) are represented dynamical forces implied in the stand.

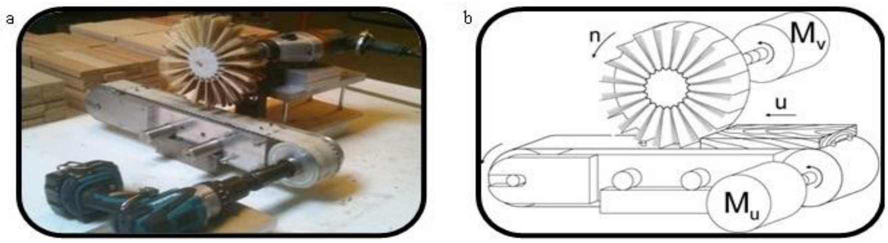

Fig. 2. (a) Experimental stand; (b)Schematic view of the experimental stand.

The main technical characteristics of the Experimental stand with brush sanding machine are as follows:

- Abrasive type: Aluminium Oxide and Silicon Carbide
- Abrasive grits: P150, P180, P220
- Brush size: Radius x width = 105.5 x 49 mm
- Lamellae length x width: 70 x 7 mm
- Sanding height: Hci (Height of initial contact:) = 18 mm
- Sanding speed: n = 450 – 700 rpm
- Feed speed: u = 3 and 6 m/min

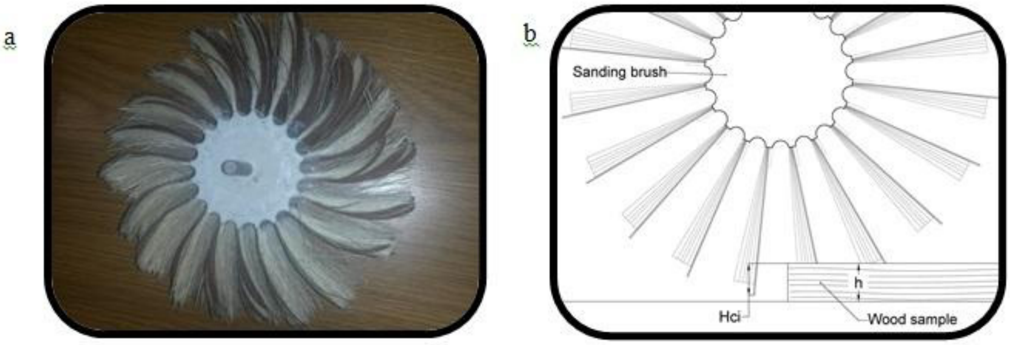

Fig. 3. (a) View of the sanding brush; (b) the height of initial contact -Hci.

- 40 samples sanded with brush sanding of P150, initially sanded with wide belt of grit size P80+120+150
- 40 samples sanded with brush sanding of P180, initially sanded with wide belt of grit size P80+120+150+180
- 40 samples sanded with brush sanding of P220, initially sanded with wide belt of grit size P80+120+150+220

According to the recommendation of [3] the brush sanding was done in two steps, first sanding against the direction of wood grain and second sanding with the grain direction, that method is applied to assure a cleaner cut, by first sanding against the grain direction the majority of microfibers will be cut, raised up or bended, and by second sanding in the direction of grain all the raised/bended microfibers will be removed.

The roughness of the 120 surfaces was investigated using Mitutoyo Surftest SJ-201equiped with stylus detector, which scans the samples, as represented in the Fig. 4.(a). The working parameters of the equipment were as follows:

- scan speed: 0.5 mm/s
- the measured length: 12.5 mm
- cut – off: 2.5mm
- number of data in a sampling length: 1666
- resolution: 3µm
- standard: ISO 1997
- filter: PC50
- profile: R

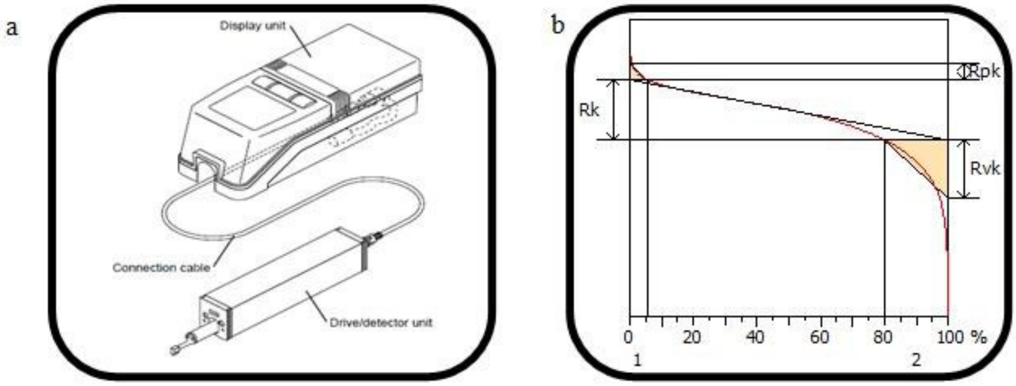

Fig. 4. (a) Roughness measuring device; (b) Roughness parameter analyser – Rk, Rpk.

The roughness profile was obtained after filtering the data with a Gaussian filter, automatically applied by the software of the measuring device. For data analysis of the roughness parameters Rk and Rpk, as shown in the Fig. 4.(b), were used the MountainsMap software from DigitalSurf.

4. **Results and discussions**

After eliminating the aberrant errors and arranging in increasing order, the roughness values of the processed surfaces obtained for the grit sizes P150, P180, P220 looks as shown in Tables 1,2 and 3 for Rk and Rpk values.

The average values of the obtained roughness for grit size P150 are presented in Table 1, and their graphic representation is shown in Fig. 5.

Table 1. Roughness values of Rk and Rpk parameters for grit size P150.

Sample	Aluminium Oxide – Rk/Rpk[μm]								Silicon Carbide – Rk/Rpk[μm]							
n[rpm]	450				700				450				700			
u[m/min]	3		6		3		6		3		6		3		6	
1.	11,01	2,14	11,3	2,06	10,01	1,84	9,13	2,36	9,2	3,04	8,3	2,13	12,34	3,03	11,3	2,31
2.	11,33	2,45	11,56	2,30	10,9	2,06	9,25	2,57	9,21	3,22	8,49	2,15	12,44	3,25	11,83	2,40
3.	11,37	2,58	11,7	2,45	10,9	2,08	9,63	2,69	9,28	3,28	8,59	2,16	12,79	3,28	12,48	2,52
4.	11,9	2,64	11,74	2,54	11,03	2,12	9,88	2,84	9,28	3,35	8,63	2,17	12,81	3,60	12,51	2,56
5.	11,9	2,80	11,74	2,61	11,03	2,24	10	2,85	9,34	3,37	8,97	2,23	12,85	3,60	12,53	2,77
6.	12,31	2,86	11,93	2,77	11,2	2,28	10,1	2,89	9,43	3,42	9,16	2,37	13,19	3,67	12,69	2,83
7.	12,31	2,97	12,09	2,77	11,27	2,34	10,24	3,10	9,66	3,61	9,34	2,37	13,45	3,72	12,78	2,83
8.	12,53	3,08	12,12	2,79	11,32	2,71	10,55	3,33	9,78	3,65	9,35	2,37	13,92	3,78	12,78	2,86
9.	12,55	3,21	12,5	2,95	11,39	2,75	10,61	3,41	10,57	3,93	9,44	2,51	14,08	3,81	12,88	2,89
10.	12,58	3,26	12,58	3,09	11,4	2,84	11,33	3,44	10,77	3,97	9,56	2,56	14,34	3,83	13,17	2,90
11.	12,6	3,35	12,6	3,09	11,43	2,88	11,41	3,47	10,82	4,00	9,68	2,63	14,87	3,88	13,24	2,94
12.	12,8	3,38	12,66	3,20	11,5	2,89	11,6	3,55	10,87	4,08	9,75	2,68	14,95	3,88	13,27	3,18
13.	12,86	3,67	12,75	3,31	12,34	2,94	11,79	3,82	11,15	4,20	9,8	2,70	14,99	4,00	13,72	3,26
14.	13,06	3,81	12,81	3,36	12,38	3,17	11,9	3,84	11,42	4,28	9,87	2,71	15,12	4,05	13,83	3,32
15.	13,41	3,87	13,1	3,54	12,7	3,32	12,6	3,86	11,49	4,31	10,38	2,83	15,15	4,07	13,84	3,72
16.	13,72	3,97	13,15	3,60	12,77	3,32	13	3,98	11,59	4,35	10,66	2,90	15,45	4,19	13,87	3,75
17.	13,73	4,10	13,19	3,61	12,87	3,45	13,1	4,01	11,6	4,38	11,07	2,98	15,68	4,41	14,1	3,77
18.	13,8	4,22	13,2	3,67	13,25	3,56	13,24	4,21	11,86	4,38	11,32	3,06	16,45	4,43	14,46	3,79
19.	14,46	4,27	13,21	3,74	13,41	3,59	13,39	4,26	11,86	4,43	11,76	3,10	16,57	4,52	14,67	4,04
20.	14,59	4,52	13,3	3,88	13,48	3,61	13,54	4,33	11,88	4,48	11,8	3,12	16,64	4,65	14,78	4,07
Average values	12,74	3,36	12,46	3,07	11,83	2,80	11,31	3,44	10,55	3,89	9,8	2,59	14,40	3,88	13,24	3,14

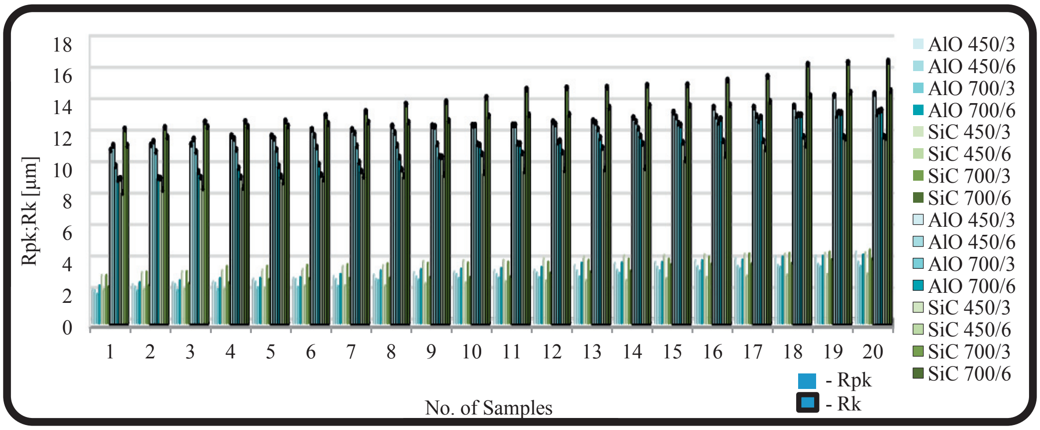

Fig. 5. Roughness values of Rk and Rpk parameters for grid size P150.

Analyzing the data's can be found the lowest values of Rpk roughness at the sanding regime with Silicon Carbide at a revolution speed of 450 rpm and feed speed of 6 m/min with an average of 2.59 µm, followed with an average value of 2.80µm for the sanding regime with Aluminum Oxide at a revolution speed of 700 rpm and feed speed of 3 m/min, the upper limit of 3.89 µm obtained with Silicon Carbide sanding at a revolution speed of 450 and 700 rpm. As an explanation, can be stated that the values are very close to each other, the lowest is 2.59 and the highest is 3.89 µm.

The obtained Rk roughness values varies between 9.8 and 14.40µm, the lowest being obtained with Silicon Carbide at a revolution speed of 450 rpm and feed speed of 6 m/min.

The average values of Rpk roughness for sanding with grit size of P180 are presented in the Table 2.

Table 2. Roughness values of Rk and Rpk parameter for grid size P180.

Sample	Aluminium Oxide – Rk/Rpk[µm]								Silicon Carbide – Rk/Rpk[µm]							
n[rpm]	450				700				450				700			
u[m/min]	3		6		3		6		3		6		3		6	
1.	7,07	1,31	7,62	1,6	10,03	2,25	8,3	2,05	6,1	2,43	6,58	1,3	12,2	3	9,14	2,01
2.	7,37	1,36	7,7	1,6	10,23	2,43	8,3	2,05	6,1	2,52	6,66	1,35	12,2	3,05	9,17	2,04
3.	7,38	1,43	7,83	1,65	10,29	2,45	8,31	2,14	6,16	2,59	6,78	1,37	12,63	3,06	9,52	2,1
4.	7,44	1,52	7,87	1,76	10,46	2,5	8,41	2,22	6,25	2,84	6,95	1,41	12,67	3,1	9,71	2,13
5.	7,47	1,54	7,93	1,95	10,48	2,52	8,5	2,23	6,3	3,06	7	1,49	12,84	3,12	9,73	2,2
6.	7,6	1,7	8,03	2	10,72	2,52	8,62	2,33	6,31	3,13	7,04	1,61	13	3,18	9,73	2,21
7.	7,62	2,01	8,06	2,08	10,76	2,54	8,72	2,35	6,35	3,15	7,11	1,65	13,27	3,28	10	2,26
8.	7,85	2,33	8,18	2,12	10,76	2,6	8,74	2,37	6,52	3,3	7,15	2,15	13,5	3,28	10,1	2,48
9.	8,09	2,33	8,57	2,16	10,8	2,61	8,83	2,54	6,55	3,32	7,18	2,16	13,57	3,28	10,3	2,77
10.	8,14	2,41	8,62	2,28	10,82	2,72	8,96	2,57	6,57	3,43	7,29	2,19	13,58	3,34	10,41	2,78
11.	8,18	2,42	8,92	2,33	11,2	2,72	9,07	2,59	6,6	3,46	7,43	2,35	13,68	3,4	10,5	2,87
12.	8,5	2,54	8,94	2,43	11,28	2,83	9,12	2,66	6,78	3,62	7,44	2,51	13,8	3,5	10,9	2,95
13.	8,57	2,56	8,96	2,63	12	2,84	9,36	2,67	6,84	3,63	7,53	2,67	13,87	3,5	11,39	3
14.	8,63	2,6	9,07	2,74	12,27	2,85	9,37	2,78	6,85	3,67	7,66	2,71	14,17	3,51	11,43	3,06
15.	8,86	2,97	9,32	2,84	12,34	2,91	9,55	2,79	7,03	3,97	7,68	2,8	14,19	3,54	11,45	3,12
16.	8,86	2,98	9,6	2,85	12,6	2,93	9,6	2,88	7,19	4,05	7,69	2,84	14,2	3,7	11,62	3,27
17.	8,92	3,06	9,68	3,02	12,61	2,93	9,73	3,01	7,28	4,21	7,83	2,87	14,34	3,74	11,79	3,35
18.	8,97	3,08	9,97	3,11	13	2,98	9,76	3,09	7,3	4,32	7,85	3,05	14,44	3,94	11,84	3,54
19.	9,07	3,08	10,31	3,14	13,04	3,01	9,87	3,1	7,41	4,4	7,86	3,05	14,95	4,06	12	3,6
20.	9,34	3,29	10,4	3,19	13,25	3,03	11	3,13	7,43	4,48	7,87	3,09	15,04	4,15	12,17	3,71
Average values	8,2	2,33	8,78	2,37	11,45	2,71	9,11	2,58	6,7	3,48	7,33	2,23	13,61	3,44	10,64	2,77

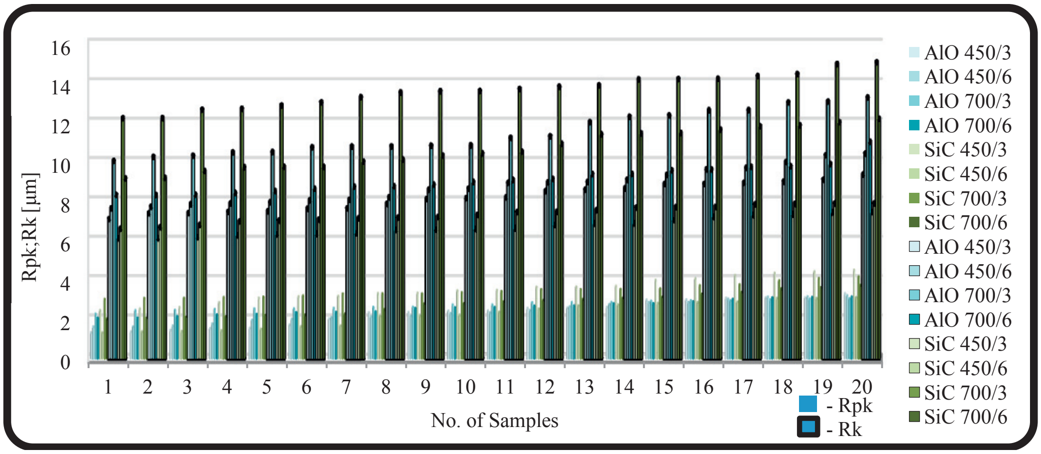

Fig. 6. Roughness values of Rk and Rpk parameters for grid size P180.

For the grit size of P180 the lowest value of Rpk roughness can be found at the sanding regime with Silicon Carbide at a revolution speed of 450 rpm and feed speed of 6 m/min with an average of 2.23 µm, followed with an average value of 2.33µm for the sanding regime with Aluminium Oxide at a revolution speed of 450 rpm and feed speed of 3 m/min, the upper value being of 3.48 µm obtained with Silicon Carbide sanding at a revolution speed of 700 rpm and feed speed of 3 m/min.

The obtained Rk roughness values varying between 6.7 and 13.61µm, the average lowest being obtained with sanding regime of n = 450 rpm, u = 3 m/min Silicon Carbide.

The average values of Rpk and Rk roughness for sanding with grit size of P220 are presented in the Table 3.

Table 3. Roughness values of Rk and Rpk parameters for grid size P220.

Sample	Aluminium Oxide – Rk/Rpk[µm]								Silicon Carbide – Rk/Rpk[µm]							
n[rpm]	450				700				450				700			
u[m/min]	3		6		3		6		3		6		3		6	
1.	6,51	2,03	5,56	1,57	7,58	2,02	6,88	2,02	6,11	1,73	5,4	1,75	6,66	1,54	6,03	2,11
2.	6,8	2,03	5,7	1,82	7,6	2,05	7,11	2,06	6,16	1,77	5,52	1,87	6,68	1,57	6,08	2,15
3.	6,8	2,08	5,73	1,96	7,71	2,18	7,11	2,06	6,4	1,82	5,56	1,93	6,76	1,66	6,41	2,17
4.	6,96	2,51	5,75	2,13	7,84	2,2	7,29	2,07	6,44	2,01	6,02	1,95	6,9	1,76	6,5	2,21
5.	7	2,59	6,11	2,23	7,89	2,24	7,47	2,1	6,46	2,31	6,09	1,98	6,92	1,98	6,65	2,25
6.	7,1	2,82	6,15	2,23	8,05	2,3	7,52	2,11	6,47	2,4	6,14	2,06	6,98	2,31	6,67	2,28
7.	7,2	2,98	6,2	2,24	8,08	2,34	7,55	2,4	6,6	2,42	6,18	2,11	7,03	2,37	6,72	2,29
8.	7,46	3,13	6,41	2,26	8,27	2,47	7,67	2,44	6,65	2,45	6,28	2,21	7,14	2,56	6,73	2,39
9.	7,59	3,39	6,62	2,4	8,69	2,48	7,7	2,45	6,68	2,47	6,32	2,22	7,56	2,66	6,74	2,51
10.	7,65	3,62	6,7	2,47	8,72	2,48	7,75	2,45	6,84	2,51	6,46	2,27	7,78	2,74	6,74	2,52
11.	7,87	3,75	6,7	2,5	8,83	2,51	7,88	2,52	6,89	2,55	6,51	2,34	7,96	2,74	6,82	2,52
12.	7,93	4,01	6,73	2,52	8,86	2,56	7,89	2,56	6,93	2,56	6,58	2,41	8,05	2,91	6,83	2,53
13.	7,99	4,02	6,76	2,56	9,03	2,57	7,9	2,6	6,96	2,63	6,65	2,57	8,15	2,94	6,88	2,54
14.	8,17	4,6	6,77	2,56	9,05	2,66	8,04	2,65	6,97	2,65	6,85	2,58	8,18	3,02	6,91	2,59
15.	8,33	4,69	6,8	2,61	9,18	2,67	8,27	2,71	6,99	2,81	6,98	2,83	8,26	3,22	6,92	2,65
16.	8,38	4,84	6,91	2,62	9,21	2,71	8,81	2,76	7,21	2,97	7,18	2,94	8,36	3,25	7	2,69
17.	8,48	4,97	7,25	2,81	9,23	2,79	8,91	2,79	7,35	3,01	7,2	2,94	8,69	3,38	7,1	2,81
18.	8,58	5,19	7,4	2,82	9,31	2,98	8,95	2,89	7,4	3,03	7,2	2,95	8,8	3,53	7,18	2,84
19.	8,72	5,47	7,53	2,86	9,4	3,04	9,01	2,93	7,4	3,23	7,44	3,07	8,93	3,53	7,19	2,86
20.	8,81	5,48	7,62	3,18	9,44	3,16	9,22	2,96	7,56	3,24	7,46	3,08	9,39	3,73	7,21	3,04
Average values	7,72	3,71	6,57	2,42	8,6	2,52	7,95	2,48	6,82	2,53	6,5	2,4	7,76	2,67	6,77	2,5

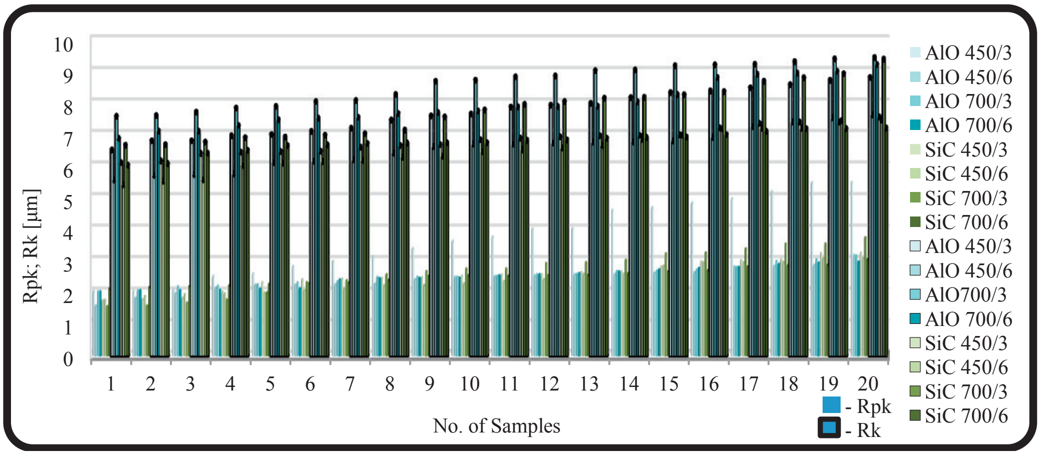

Fig. 7. Roughness values of Rk and Rpk parameters for grid size P220.

For the grit size of 220 the lowest value of Rpk roughness can be found at the sanding regime with Silicon Carbide at a revolution speed of 450 rpm and feed speed of 6 m/min with an average of 2.4 µm, the upper limit of 3.71 µm obtained with Aluminum Oxide sanding at a revolution speed of 450 rpm and feed speed of 3 m/min.

The obtained Rk roughness values varying between 6.5 and 8.6 µm, the lowest being obtained with sanding regime of n = 450 rpm, u = 6 m/min Silicon Carbide.

As expected, the average values of the roughness obtained through sanding with different grit sizes decrease with increasing grit, both for the parameter Rk and for Rpk. For Rk, the decrease amount is ca. 4 µm and for Rpk is 0.5 µm for an increase of the grit size from P150 to P220 and only 1 µm for Rk and 0.1 µm for Rpk, for an increase of the grit size from P150 to P220. For Rpk and Rk, the decreasing tendency is constant between the grit size P150 and P180 respectively P180 and P220.

The Wide belt sanding studied by the author [1], are regarding the same roughness parameters Rk and Rpk, the obtained values are compared with Brush sanding presented in this paper to establish the differences of the two sanding methods and the given results. In the Table 9 are laid down the values of the wide belt sanding and the brush sanding with the Rk and Rpk parameters.

Table 4. Comparison between values obtained at Rk and Rpk wide belt sanding and brush sanding.

Sample Grid size	Brush P150		Wide Belt		Brush P220		Wide Belt	
Roughness parameter	Rk[µm]	Rpk[µm]	Rk[µm]	Rpk[µm]	Rk[µm]	Rpk[µm]	Rk[µm]	Rpk[µm]
1.	8,30	2,13	9,44	4,14	5,40	1,75	8,85	3,03
2.	8,49	2,15	9,73	4,21	5,52	1,87	8,95	3,18
3.	8,59	2,16	10,02	4,51	5,56	1,93	9,01	3,27
4.	8,63	2,17	10,81	4,79	6,02	1,95	9,18	3,35
5.	8,97	2,23	10,84	4,93	6,09	1,98	9,18	3,44
6.	9,16	2,37	11,19	5,02	6,14	2,06	9,23	3,69
7.	9,34	2,37	11,49	5,14	6,18	2,11	9,32	3,72
8.	9,35	2,37	11,54	5,16	6,28	2,21	9,57	3,74
9.	9,44	2,51	11,60	5,20	6,32	2,22	10,02	3,79
10.	9,56	2,56	11,67	5,25	6,46	2,27	10,12	3,86
11.	9,68	2,63	11,82	5,34	6,51	2,34	10,13	3,95
12.	9,75	2,68	11,85	5,52	6,58	2,41	10,15	3,96
13.	9,80	2,70	12,00	5,54	6,65	2,57	10,48	3,98
14.	9,87	2,71	12,05	5,62	6,85	2,58	10,56	4,19
15.	10,38	2,83	12,26	6,74	6,98	2,83	10,66	4,23
16.	10,66	2,90	12,45	7,39	7,18	2,94	10,88	4,66
17.	11,07	2,98	13,33	7,65	7,20	2,94	10,94	4,71
18.	11,32	3,06	13,58	7,68	7,20	2,95	10,96	5,31
19.	11,76	3,10	13,96	8,91	7,44	3,07	11,18	5,42

20.	11,80	3,12	14,94	9,20	7,46	3,08	11,50	6,31

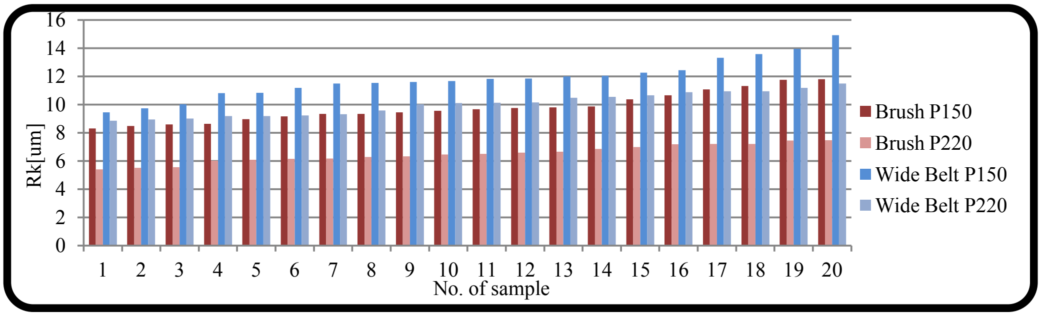

Fig. 8. Comparison roughness values of Rk between brush and belt sanding.

As we can see in Fig. 8 for sanding with abrasive brush with grit size P150 the Rk values are between 8.3 and 11.8 µm while the wide belt Rk value are between 9.4 and 15 µm. It can be seen that abrasive brush cut better the fiber than wide belt. For brush sanding with grit size P220 the obtained values are between 5.4 and 7.5 µm lower than the wide belt Rk values which are between 8.8 and 11.5 µm.

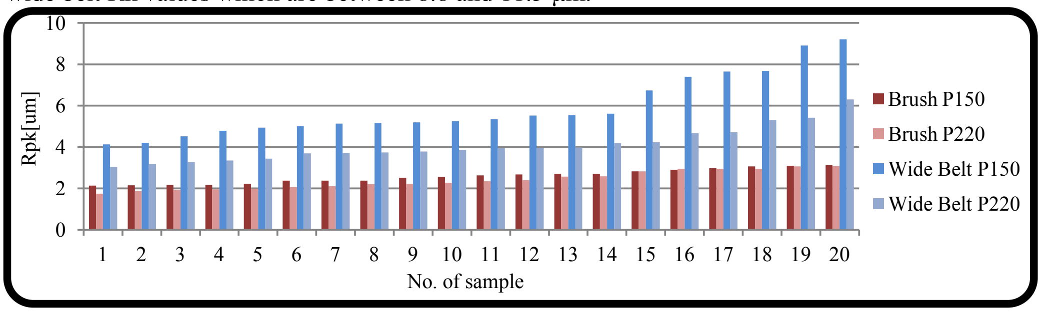

Fig. 9. Comparison roughness values of Rpk between brush and belt sanding.

For Rpk parameter we can see in Fig. 9 that for sanding with abrasive brush the roughness values are little then on wide belt sanding. By sanding using grid size P150 the values are between 2.1 to 3.1 µm for abrasive brush and from 4.1 to 9.2 µm for wide belt. For grid size P220 the result are between 1.7 to 3 µm for abrasive brush and from 3 to 6.3 for wide belt.

5. Conclusions

When trying to create a particularly smooth surface the abrasive particles tend to be loaded rather quickly so that in industrial application is not possible to utilize the finer grits of abrasive. Is observed that with finer grit sizes the abraded material from the wooden articles comprising fibers cannot be removed from the abrasive article or belt, and inhibits further abrasion. [8]. Another problem is that the sanded wooden pieces show a significant number of loose fibers, they tend to lift up and cause protrusions in the lacquer layer, [4]. As a solving method for the described problems was implemented the actual research presented in this paper by using the abrasive brushes based on the principles of sanding by which the aggressive sanding is accomplished by the speed of the revolving tool [7].

This research shows that by sanding with abrasive brush can be obtained quality surfaces, processing roughness Rk varying between 5.4-11.8 µm, compared to 8.8-15 µm at wide belt sanding and raised fiber roughness Rpk varying from 2.3 to 3.9 µm compared to 3-9 µm at wide belt sanding. After sanding with wide belt and applying the first layer of lacquer the fibers are raising due to the fiber wetting which causes the swelling of wood material. Accordingly, as the fiber roughness is greater than the phenomenon of raised fiber is more apparent, thus with brush sanding the Rpk is between 2.3-3.9 the phenomenon is reduced comparing to the wide belt sanding where Rpk is between 3-9 μm, this phenomenon produces air bubbles and also the discontinuity of lacquer layer. In order to eliminate this defect after wide belt sanding is requires additional sanding with a sanding brush to remove the fibers. Also regarding to the obtained surface quality was found that sanding with brush with Silicon Carbide can be achieved surfaces with average of Rpk parameter equal 2.23 μm, lower than sanding with Aluminum Oxide which increases the average value of Rpk from 2.33 μm.

For beech species best results are obtained when these are sanded with a rotation speed of 450 rpm and a feed speed of 6 m/min. As expected, roughness values decrease in the same time when grit size is less from P150 to P220.To confirm the quality of surface, when speaking strictly from the viewpoint of roughness, when sanding beech wood on the radial section, two passes are sufficient to obtain finally a surface in quality class 10 [6].

According to the obtained results it can be stated that with abrasive brushes can be removed the loose fibers from the wooden articles and the obtained roughness of Rk and Rpk is considerably lower than the ones obtained after wide belt sanding. As a conclusion can be specified that after sanding with wide belts prior to lacquering, it is necessary to process the wooden surfaces with abrasive brushes, in order to remove the loose fibers and to obtain a better surface roughness.

Further researches are proposed on different type of wood materials and different heights of initial contact Hci that should give an overview about the influence of wood hardness and the ability of the abrasive brush for denibbing according to height position.

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