



WOOD FILLED PLASTICS MACHINING AND SURFACE QUALITY



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INTRODUCTION

Components made of **wood plastic composites** are used in exterior application, where in comparison with nature wood composite do not require further maintenance (predetermine to long-term usage for its physical and mechanical properties). Nowadays demand on wood plastic composites is with increasing character. For this reason, a better understanding of this composite material in regards to machining and texture of surface is necessary. The paper deals with a comparison of the surface roughness of Wood Plastic Composite with traditional wood (oak) after turning. Presented paper is focused on observation changes of average maximum height Rz with change of speed of feeds f and speed of rotations n_c .

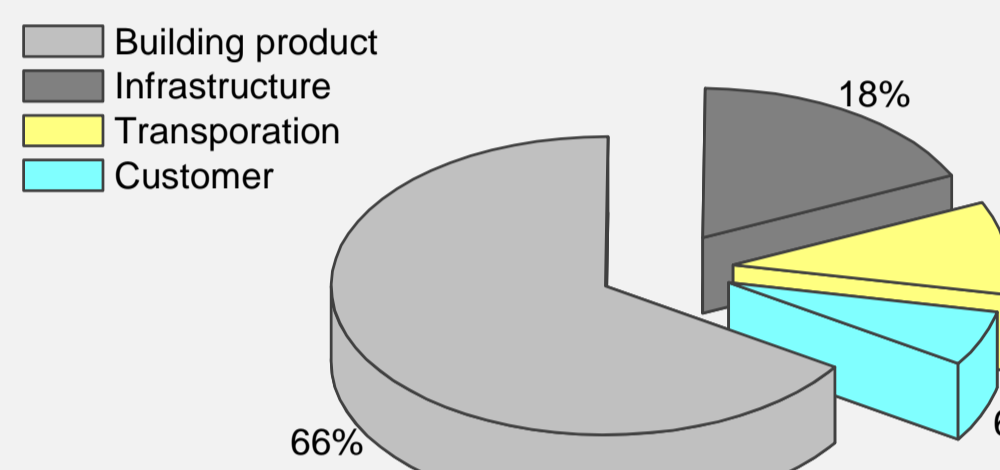


Figure 1. Applications of Wood Plastic Composite

MEASURING SET UP

Qualitative evaluation of surface roughness (Rz – maximal height of the profile) was realized by standard **STN EN ISO 4287**. Measurement was realized with MITUTOYO SJ-400 (measuring length $l=4$ mm). Roughness was measured in three independent areas with repeatability 15x. Statistical confirmation of extreme deviation was evaluated by Grubbs test with accuracy 0.05. Subsequently was calculated arithmetical averages in individual areas and evaluated summary arithmetical average (using in graphs).

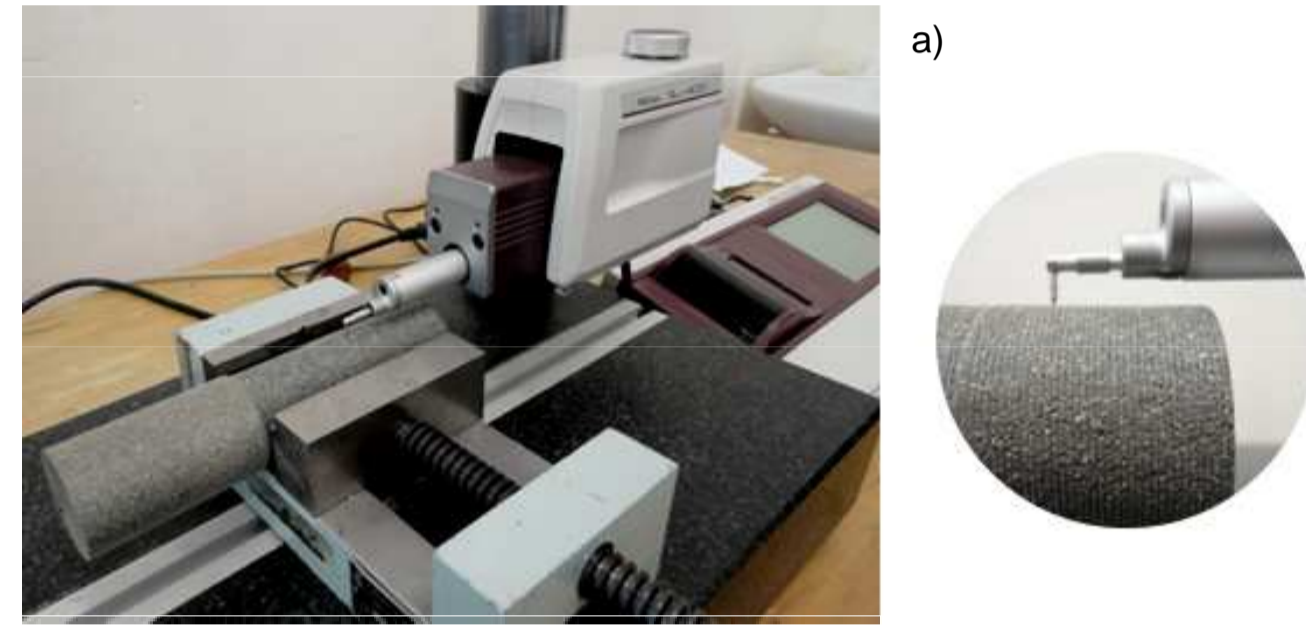


Figure 2. a) Principle of measuring by MITUTOYO SJ-400 b) texture of profile after turning

CONCLUSIONS

Quality of surface after machining is theoretically directly dependent on combination of tool tip radius and feed rate. Real values of characteristic Rz are significantly higher than predicted (despite the fact that, for all three comparing courses is increasing tendency). WPC samples were cut in two quadrants before experimental measuring what cause differences in values of surface roughness parameter Rz and also variant material properties in various areas, which is resulting of inhomogeneity of the material. Confirm of statement is demonstrated by mechanical test – tensile test and three point bend test. Values of tensile strains are different of less than 10 MPa. Considering that experimental samples were cut from center of the extruded profile in direction of extruding can be state that differences on the edges of the profile would be differences in mechanical properties significantly differ. Wood plastic composite materials are machinable with cutting tools intended for wood materials with maintaining similar geometry.

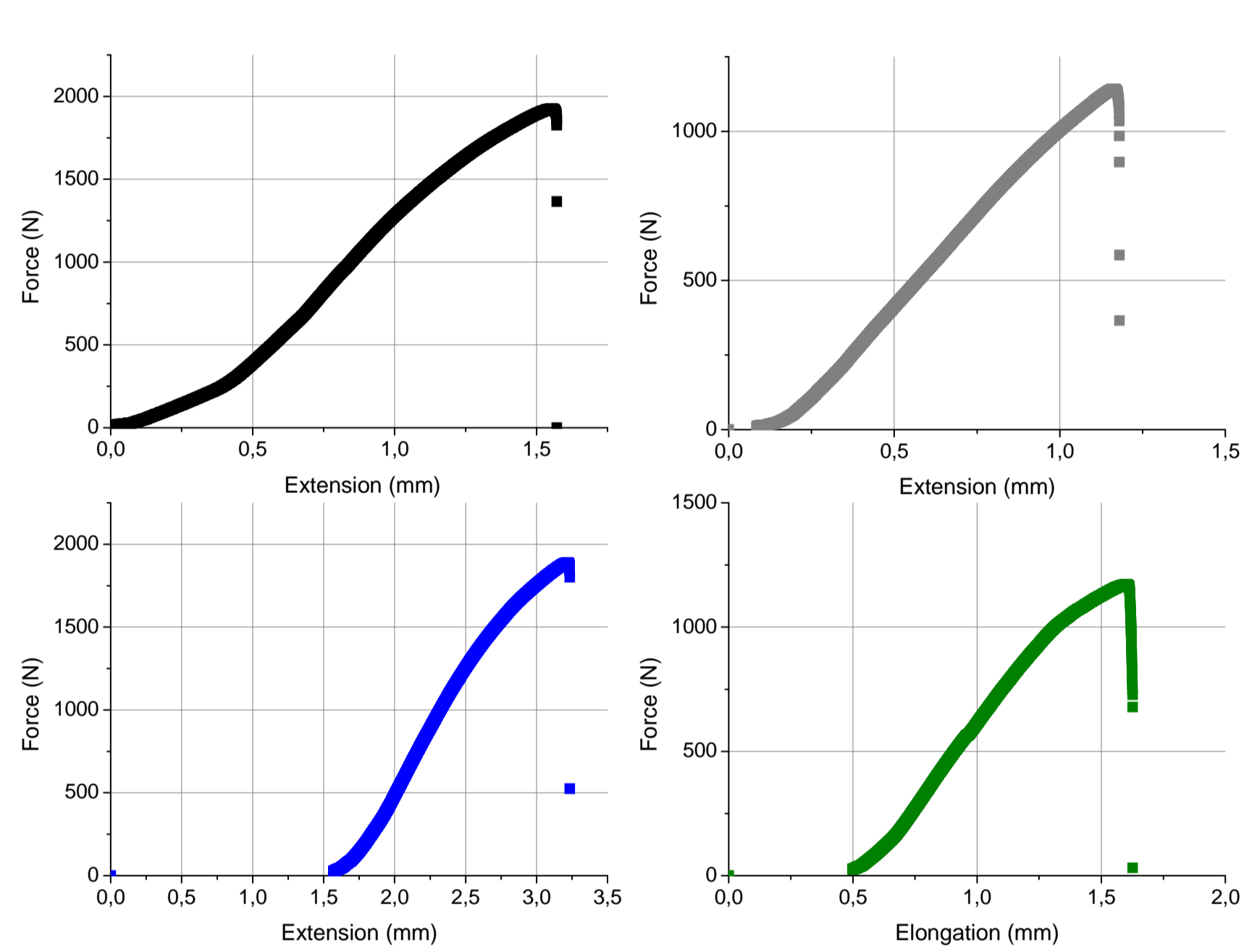


Figure 3. Load diagrams – tensile test of samples 1 – 4

Turning was realized with monolithic cutting tool made of high speed steel (EN ISO HS6-5-2) with positive geometry with tip radius $r_{\epsilon}=5$ mm. Process of turning was characterized by two variable parameters – **feed rate per revolution** 0.1, 0.3, 0.61 mm and **spindle speed** $n_c=450, 900, 1400$ min^{-1} . Cutting was realized without using process fluids. Machining of WPC was in direction parallel to extruding axe, and verification sample in parallel fiber direction. Sequence of final operation to prepare samples with required dimension was done by following steps:

1. Cutting by frame saw → samples length 150 mm,
2. Cutting by frame saw → samples with square cross section 40x40mm,
3. Turning → to diameter $\varnothing 36$ mm,
4. Final turning to required dimension at depth of cut $a_p=2,5$ with tool geometry described above.

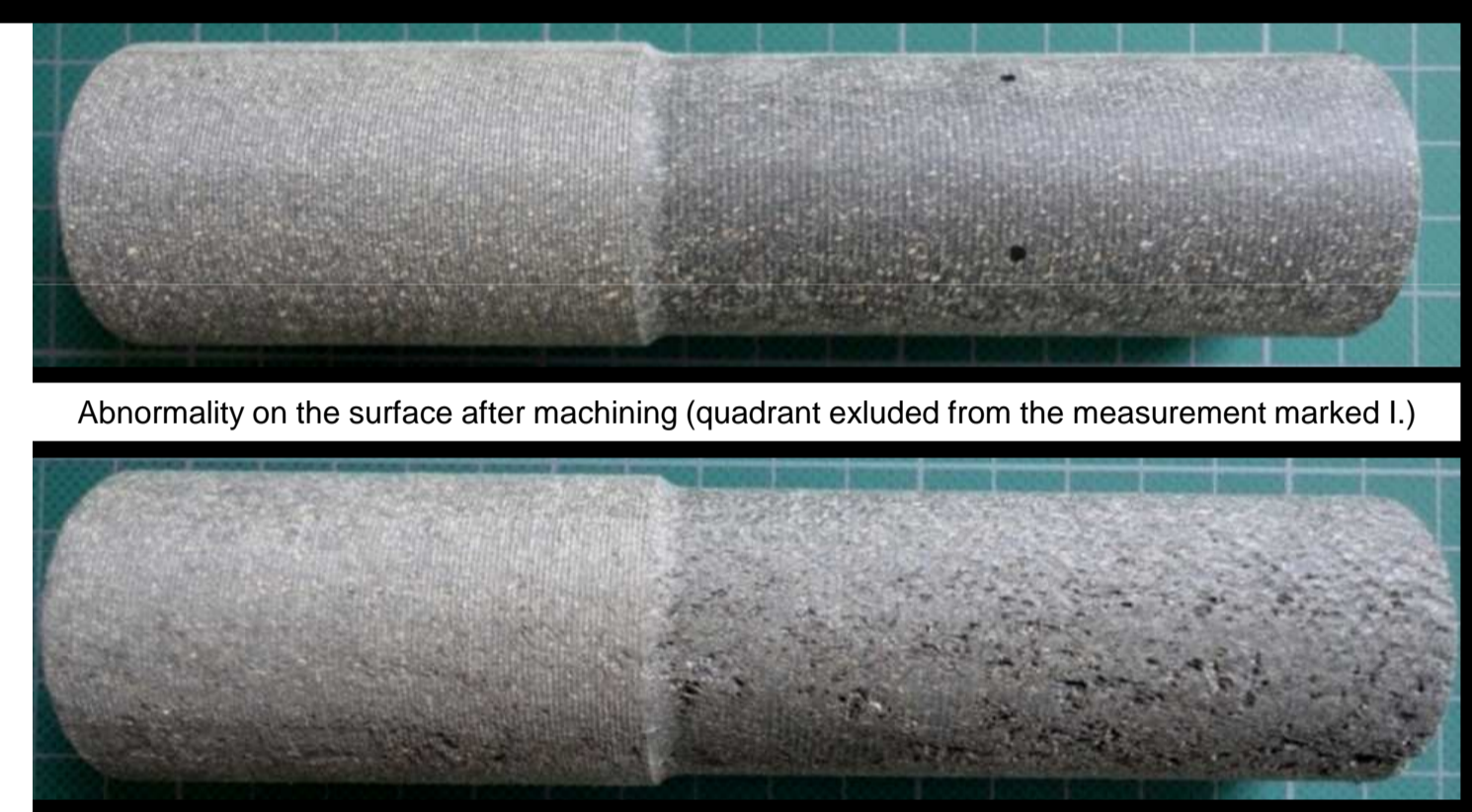
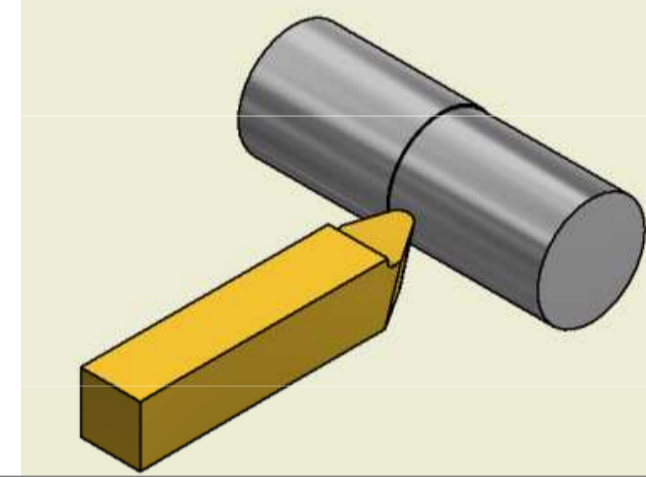


Figure 4. Define quadrant I. and quadrant II. for WPC samples



TURNING OF WOOD PLASTIC COMPOSITE

First graph

Histogram of measured values Rz at minimum spindle speed for composite and wooden sample. Higher values of surface roughness parameter Rz was monitored at composite sample wood plastic at spindle speed 450 rpm, where is maximal difference at feed rate per revolution 0.3 mm (No. of samples – **WPC2-W2** – distinction is 15.72 μm).

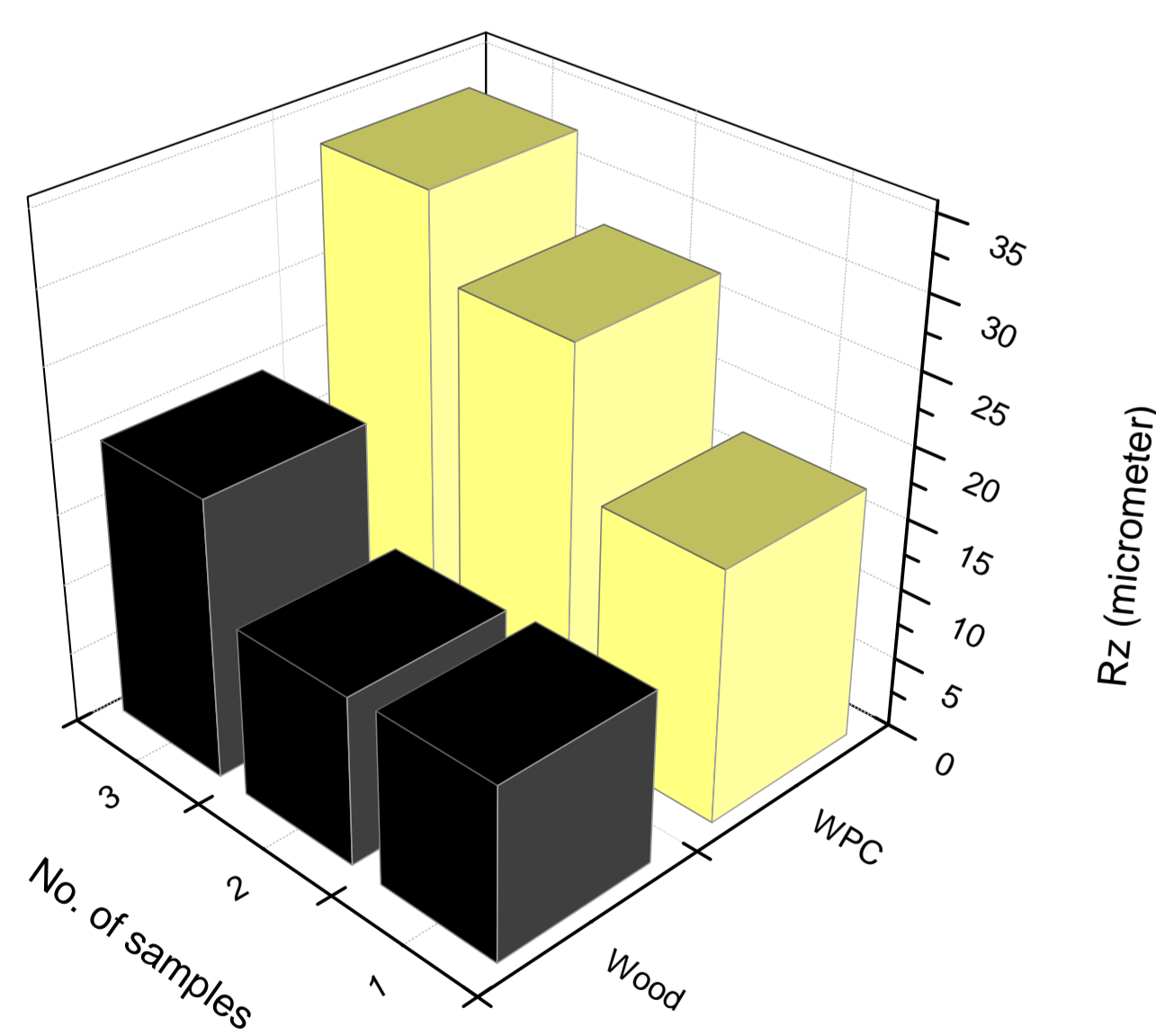


Figure 5. Histogram of Rz at spindle speed 450 rpm for WPC and verification sample

Second graph

Histogram of measured values Rz at maximum spindle speed for composite and wooden sample. Higher values of surface roughness parameter Rz was monitored at composite sample wood plastic at spindle speed 1400 rpm is described occasion similar. Difference is 17.85 μm at samples **WPC8-W8** (feed rate per revolution 0.3 mm).

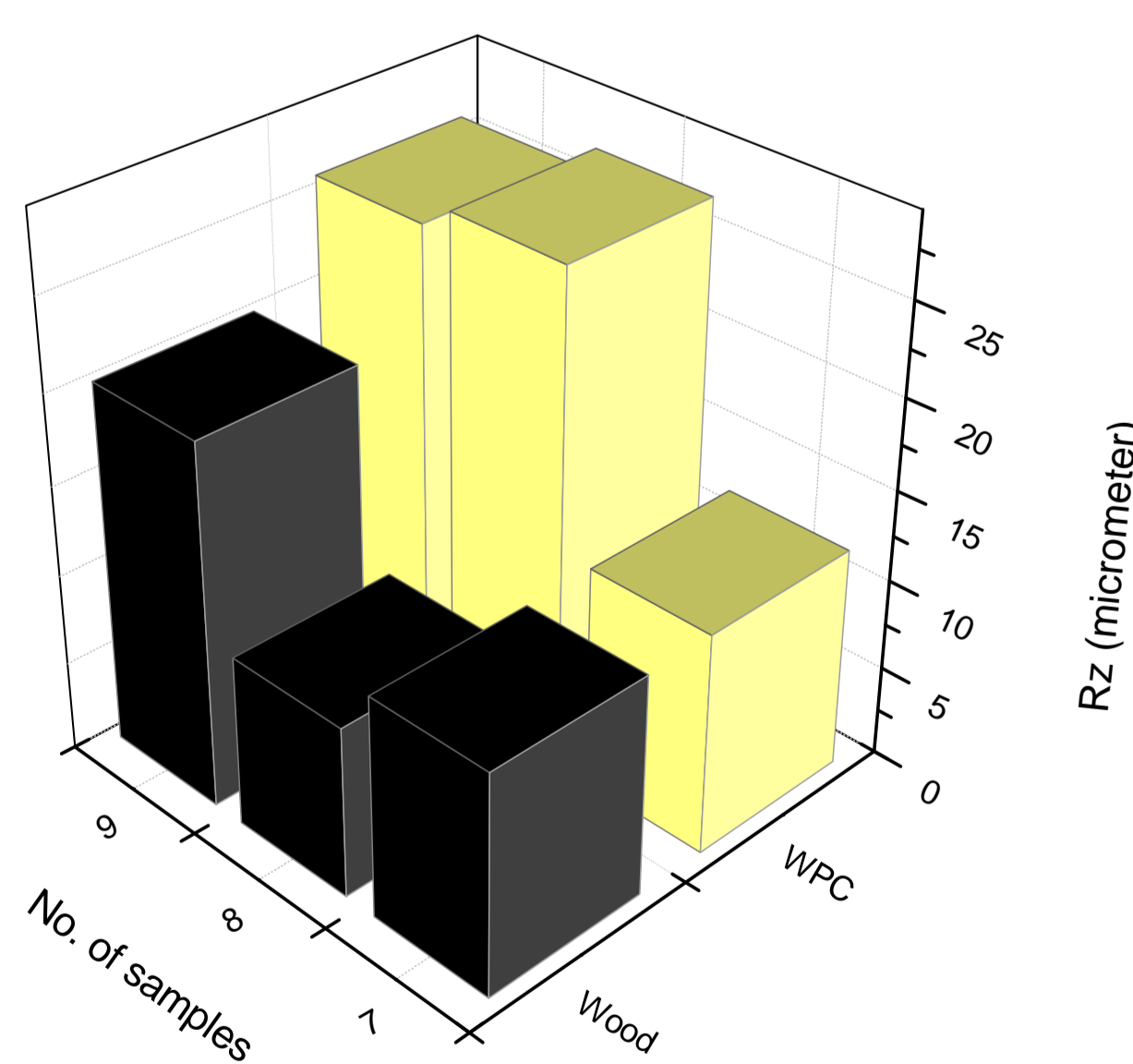


Figure 6. Histogram of Rz at spindle speed 1400 rpm for WPC and verification sample

Third graph

Monitoring three independent places on the surface from the sight of surface quality and parameter Rz can be stated, that was acquired differences, where significant changes are described in figure follows. Sample WPC5 was measured in three independent areas, where maximal deviation was determinate to 7 μm .

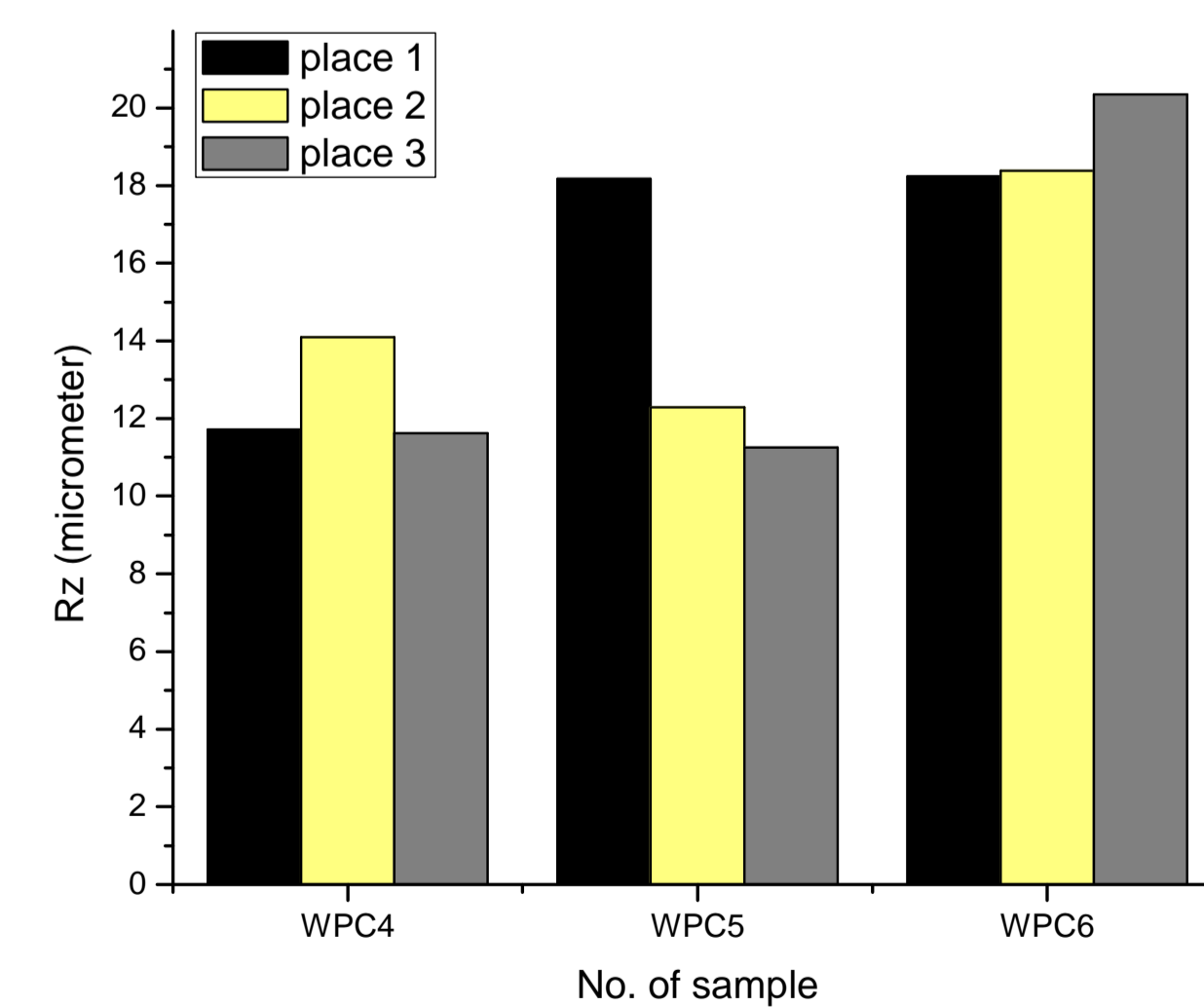


Figure 7. Verification sample W8 – maximal differences among measured values Rz (measuring 3 independent surface areas) – feed rate per revolution 0.3 mm and spindle speed 1400 rpm

Procedure of solution

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