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Effect of feed rate on quality during drilling different types of particleboard

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Abstract: *Effect of feed rate on quality during drilling different types of particleboard.* In the article an influence of the feed speed on the quality while drilling holes in four types of the particleboard was described. Comparing the machinability of chosen materials according to the criterion was a purpose of research qualities.

Keywords: particleboard, MFP, OSB, quality, drilling, machinability

INTRODUCTION

Particleboards are most common wood-based materials used in practice. Laminated particleboard and raw particleboard in furniture manufacturing, and MFP (Multi Functional Particleboard – P5 type) and OSB in building. All mentioned materials and generally wood based materials as a group are routinely machined, and and consequently also drilled [Podziewski, Górski 2010, 2011].

Today the wood industry is most clearly based on the serial or mass production. From the other side we can observe adapting the production to very different, specific orders trending . Effective and fast preparing of the peculiar production, is becoming increasingly more important service which demand appropriate methods. Moreover there is one basic, economic problem - reducing production costs is always required.

Problem of technological preparing of the production and every machining process consist of number of issues: [Morek 2012]:

- engineering knowledge bases for expert systems assisting the CAM in frames selection of machining parameters,
- algorithms of the selection of the toolkit for more than one technological operation,
- optimization of parameters of processing, including paths of the tool,
- physicochemical phenomena occurring as part of the process of processing.

The use of knowledge about machinability of different construction materials is a part of optimizing a production process. The work focused on a machinability of some wood-based materials observed during drilling process. The criterion of the machinability taken into consideration was quality of drilling, which is often considered most crucial.

MATERIALS AND METHODS

Four standard particleboard types were tested: raw particleboard, laminated particleboard, MFP and OSB. Samples of all materials were cut in following dimensions: 35mm wide, 140mm long and 18mm thick. Test drilling was conducted witch a standard CNC machine BUSELLATO Jet 130. The drill bits used in experiments were new Leitz 10mm

diameter, single bladed with a cutting edge made of polycrystalline diamond. Drilling was carried out in series of 20 holes for each of 7 variants of feed speed. After machining holes were photographed from both sides (entrance(I) and exit(O) of the drill bit) and measured.

The result photographs (selected photos of each tested material are shown in figure 1) were measured and two types of quality indicators were determined:

$$A = \frac{D\max - D}{2} \qquad B = \frac{D - D\min}{2}$$

where:
A, B – two different (external and internal type) drilling quality indicators,
Dmax – a diameter of a circle covering total damaged area which were observed outside a hole,
Dmin – a diameter of a circle covering a real hole (this diameter was generally less than the nominal diameter because of damages which were observed inside the hole),
D - nominal diameter of the hole.

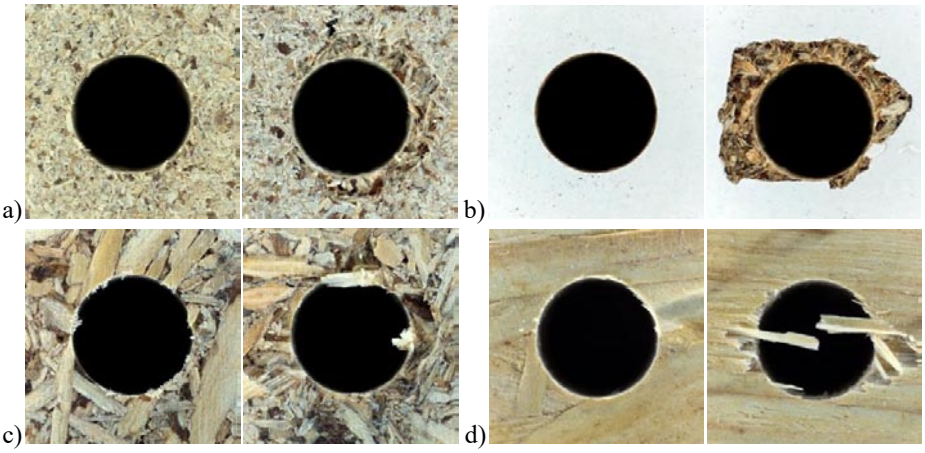

Figure.1 Selected photos of each tested material: a) particleboard, b) laminated particleboard, c) MFP, d) OSB.

The results of quality measurement are presented in figures 2-5 (mat.1 – raw particleboard; mat.2 – laminated particleboard; mat.3 – MFP; mat.4 – OSB).

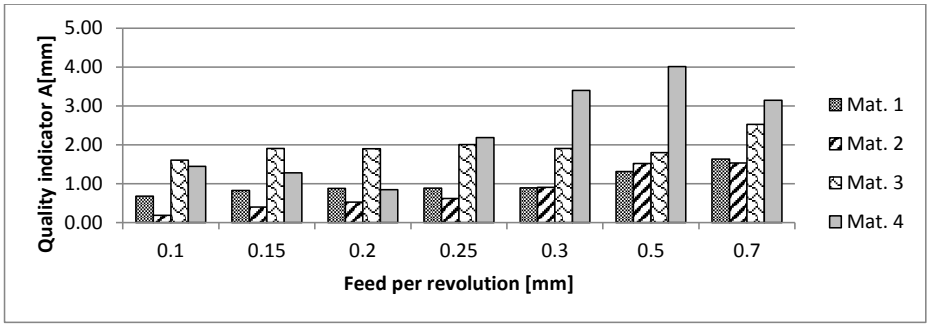

Figure 2. The effect of feed rate on the quality indicator type A measured on the entrance of the drill bit

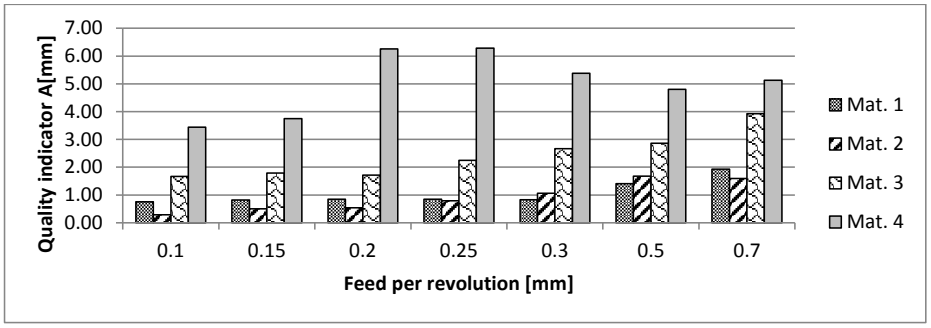

Figure 3. The effect of feed rate on the quality indicator type A measured on the exit of the drill bit

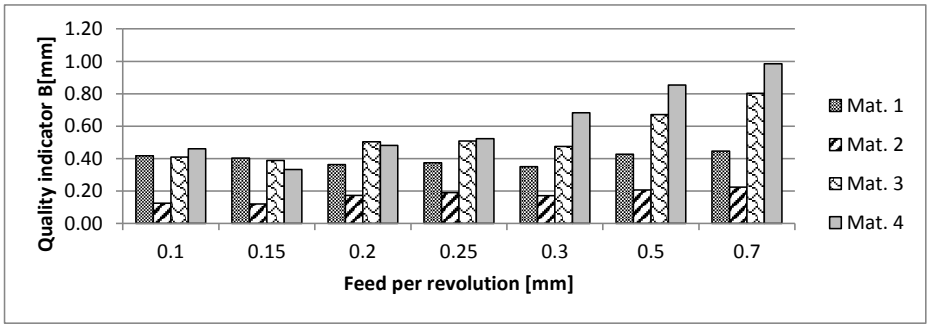

Figure 4. The effect of feed rate on the values of quality indicator type B measured on the entrance of the drill bit

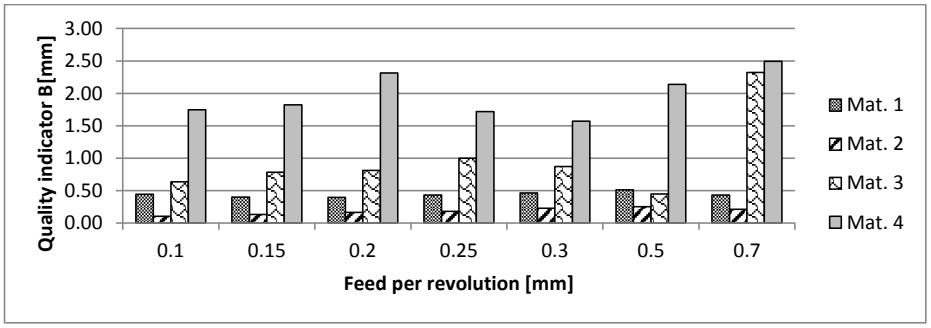

Figure 5. The effect of feed rate on the quality indicator type B measured on the exit of the drill bit

In this case, machinability during drilling for the criterion of quality is considered better when value of indicator is lower.

In figure 2 values of quality indicator type A observed on the side of entrance of the drillbit are presented. Values of indicator show strong linear relationship with values of feed per revolution for material 1 and 2 (raw and laminated particleboard). Figure 3 demonstrates values of indicator A observed on the exit of the drill bit side of the materials. Values of three materials show strong linear relationship with values of feed. Coefficient of determination for raw and laminated particleboard and MFP are between 0,87 and 0,94.

For indicator type B measured from side of the entrance of the drill bit (values shown in figure 4) relationship with values of feed per revolution are strong for MFP and OSB (R^2=0,91

and 0,95) Indicator B, measured from side of exit of the drill bit, values show no significant relationship with feed.

Among the tested materials clearly stood out OSB (mat.4) that, especially for higher feed speeds, obtained the highest values of the quality indicators.

CONCLUSIONS

The obtained results allow to formulate the following conclusion: the feed per revolution had a linear effect on quality indicator type A.

The complete characterization of the materials require an analysis of all proposed indicators.

In case of OSB values of the quality indicators are significantly higher than in remaining materials, this is easily observed for higher feeds per revolution.

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Streszczenie: *Wpływ prędkości posuwu na jakość wiercenia w różnych typach płyty wiórowej.* W artykule opisano wpływ prędkości posuwu na wartość wskaźników jakości podczas wiercenia otworów w czterech typach płyty wiórowej. Celem badań było porównanie skrawalności wybranych materiałów wg kryterium jakości.

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