Dear Dr Andrea Berger-James, Editor,

We are truly grateful for your and other reviewers’ critical comments and thoughtful suggestions on the manuscript “Enhancing removal performance and inhibiting blocking behavior through controlled morphology and arrangement of structured abrasive grits: A case study on MDF sanding” (Submission ID ec5a7365-3ad5-46cf-9a66-e289e8e761ad). Based on these comments and suggestions, the manuscript has been revised carefully. All the changes were made under “Track Changes” mode in Microsoft Word. The details of the changes are given below, for your convenience the responses for each reviewer have been classified into three sections. The plain type is the reviewers’ initial comments, the blue text is a general statement by the authors and the red text is a direct change that was made in the manuscript.

We believe that the comments and suggestions have been very useful to improve the manuscript. We hope that all these changes can make the resubmitted manuscript fulfill the requirements of the European Journal of Wood and Wood Products.

Look forward to hearing from you soon.

Sincerely yours,

Bin Luo on behalf of the authors

Response to reviews

First, we wish to express our sincere thanks to the reviewers for providing their professional comments, which were of great help to us. According to the comments, we have revised our manuscript. Our detailed response to each reviewer is summarized in this letter, for your convenience the responses for each reviewer have been classified in two or three sections. The plain type is the reviewers’ initial comments, the blue text is a general statement by the authors, and the red text is the revision in the updated manuscript.

Response to Reviewer 1

Dealing with the machining treatment of wood and wooden materials, it is necessary to specify the quality change for the cutting tool (in this case of the designed sanding belts) equally as the surface quality of the treated material (in this case, MDF board). From this aspect, the issue treated in this paper is attractive and relevant. Nevertheless, I need to require considering the following recommendations:
1. The title is unclear and ambiguous.

Response 1: Thank you for your significant comment. The title has been modified to “Sanding performance and failure progress of precision-shaped abrasive belt during sanding MDF”.

2. I have gone through the paper three times; however, I cannot grasp whether the authors evaluated only the variations in the properties of the tested sanding belts or also the surface quality of the MDF specimens treated with these belts. This comment concerns the figures, the tables, as well as the related text in the chapter Results and Discussion. Such facts need clear specifications. This comment is also valid for the Abstract, the Results and the Conclusions.

Response 2: Thank you for your diligent review of our paper and for providing valuable feedback. We apologize for any inconvenience caused by our lack of clarity in the referential relationships within the text. We have conducted a thorough review and revision of the manuscript, specifically focusing on clarifying the referential relationships throughout the text, as well as within figures and tables. The revisions were highlighted in yellow in the uploaded manuscript.

In this manuscript, we evaluated the MDF removal amount when using abrasive belts, the surface roughness of MDF samples sanded by abrasive belts, and the mass loss of abrasive belts. The following is a concise summary of the results and discussion section. For more specific details, please refer to the uploaded manuscript.

Results and discussion
In Section 3.1, an analysis and discussion were conducted to evaluate the MDF removal performance achieved through sanding with OCA and PSA. Figure 4 visually represents the varying MDF removal amounts with increasing sanding times for different abrasive belts. Paragraphs 1 and 2 provide a descriptive and analytical interpretation of the data presented in Figure 4. Furthermore, in Paragraph 3, the findings from Figure 5 are incorporated to explain the underlying reasons for the observed variations in MDF removal amount when using OCA abrasives. To further investigate the influence of factors such as grit height consistency, the contact area with the specimen, and the mechanical analysis of grit models on the removal performance of abrasive belts, separate discussions were conducted in the form of Figure 6 and its corresponding paragraph (Paragraph 4), Figure 7 and Table 3 along with their respective paragraph (Paragraph 5), and Figure 8 along with its corresponding paragraph (Paragraph 6), respectively.

Section 3.2 focuses on the analysis and discussion of the experimental results about the surface quality of MDF treated with various abrasive belts. Figure 9 visually presents the experimental findings, and paragraph 1 offers a detailed description of it. Paragraphs 2-5 conduct an analysis of the relationship between PSA grit parameters and the surface processing quality of MDF. This analysis incorporates both Figure 9 and Figure 10 to explore the underlying factors from the perspectives of the contact area between the grits and the MDF, as well as the surface morphology of the abrasive belt.
Section 3.3 explores the mass changes and blocking conditions of different abrasive belts during sanding process, along with an analysis of the sanding belts’ failure processes. Figure 11 depicts the abrasive belt masses over the course of sanding, while paragraphs 1 and 2 conduct a detailed analysis of these data changes. Furthermore, paragraph 3, in conjunction with Figure 12, investigated the blocking conditions occurring on the belt’s surface, offering insights into the factors influencing mass changes. In paragraph 4, aided by Figure 13, the study analyzes the reasons behind the reduced blocking and failure observed in PSA abrasive belts, using a mechanical model of chip removal in the chip removal channel.

In the abstract and conclusion sections, we have also made necessary revisions to enhance the clarity of the descriptions. Thanks again for your valuable insights.

3. I cannot judge if this shortcoming is due to the cumbersome description of the results or to the inadequate authors’ English. I cannot even exclude my own English inadequacy resulting in inappropriate text understanding. In such a case, I need to apologise to the authors.
Response 3: We apologize for any inconvenience caused by the cumbersome description in our previous manuscript. The uploaded manuscript has been revised by a native English speaker.

4. If the results only cover the evaluation of the sanding belts quality, they need to be supplemented with the experimental results of the evaluation of MDF surfaces obtained using different sanding belts.
Response 4: Thanks for your significant reminding. The experimental results include the removal performance of different abrasive belts, the surface quality of MDF sanded by different belts, and the mass changes of the abrasive belt. The evaluation of MDF surfaces obtained using different sanding belts is described in paragraphs 1-2 of Section 3.2. (Page 10-11)

5. In every case, I would recommend a thorough English revision, by a native speaker, if possible.
Response 5: Thank you for your suggestion. We sought the assistance of a native English speaker to revise and polish the manuscript, with all the modifications indicated in the revised paper in a specific marking color.

6. What about the grit size? Is the figure in the Table 1 (grit sizes 220) in force for each sanding belt?
Response 6: Thank you for your question. In the study, the granularity of all abrasive grits used to produce PSA is 220, as detailed in Table 1. Additionally, the abrasive grit size of OCA is also 220 and this information has been included in Section 2.2 of the uploaded manuscript. (Page 4)

7. Formal comment: Abbreviations are not allowed at sentence beginning, see e.g. the first sentence Chapter 3.1 (Fig. 4 shows the change….; ale Figure 4 shows the
Response 7: Thank you for your significant reminding. This part has been revised according to your comment. And we have also reviewed and made revisions in the following passage. (Page 6)

Response to Reviewer 2

An interesting manuscript on improving the performance of sanding belts used in the woodworking industry. The manuscript focuses on a new type of precision-shaped abrasive belt (PSA) and compare their sanding performance on MDF and their service life with an ordinary coated abrasive belt (OCA). It was found that PSAs showed a better sanding removal stability, but poorer surface quality than the OCA. Also, the side-face angle of pyramidal PSA is an important factor on the removal efficiency, surface quality and wood residue removal.

Abstract

- Comment: The abbreviations OCA and PSA are sometimes used to replace a singular abrasive belt, and other times multiple belts, alongside the use of the plural term (PSAs). The authors might consider standardizing the use of these two abbreviations through the manuscript by using one term in the singular, e.g., OCA and PSA for a single belt, and, in the plural (OSCs and PSAs) for several ones.
  
  Response 1: Thanks for your significant reminding. We have thoroughly reviewed the entire manuscript and made revisions to ensure that the singular and plural forms of abbreviations for abrasive belts are properly distinguished within the paper.

- Line #6: As a control group, the OCA was used ....
  Comment: Since a single (OCA) was used as a benchmark, it would be more appropriate to replace the term "control group" by the term "control reference".
  Response 2: Thank you for your nice advice. In both the abstract and the main body of the paper, the term “control group” has been revised to “control reference”.

- Line #14: ... a crucial role in chip removal, line #15: blockage by wood chips.
  Comment: The term "chips" is widely used for woodworking operations, such as planing, shaping, sawing, chipping, etc., that produce wood chips. The wood residues produced by the sanding process are mainly in the form of particles and dust, not chips. The authors may take this comment into consideration and modify the term "chip" to ease the reader's understanding
throughout the manuscript. However, as experts in the field of wood sanding, the authors may choose to retain the term "chips" as it is.

Response 3: Thank you for your valuable comment. The term "dust" has been substituted for "chip" in the abstract. Furthermore, it has also been altered throughout the subsequent main text to avoid any potential misunderstanding for the readers.

1 Introduction

- Line #14: when sanding wooden materials (Očkajová et al. 2016), particularly medium density fiberboard (MDF).
  Comment: As the cited reference (Očkajová et al. 2016) does not mention MDF, it would be recommended to add another reference or explain why the "blocking" problem is particularly noticed when sanding MDF than other wooden materials.
  Response 4: Thanks for your valuable comment. Two references have been added to the Introduction and explained why the “blocking” problem is particularly noticeable when sanding MDF in the updated manuscript as follows:

  “The phenomenon of “blocking” is significant in sanding wooden materials (Očkajová et al. 2016), particularly medium-density fiberboard (MDF). This issue is attributable to the higher dust production during MDF sanding compared with natural wood (Chung et al. 2000), and the fine texture of dust generated in the sanding process (Ding et al. 2020).” (Page #2)

- Before the last line: … with different arrangement.
  Correction: the word “arrangement” should be in the plural.
  Response 5: Thank you for your correction. The modification have been made in the penultimate sentence of the Introduction.

2 Material and methods

2.1 Experimental materials
2.2 Preparation of PSA
  - Figure #2:
    o Caption: Five kinds of θ of PSA: 30, 60, 90, 120, 150°.
    Suggestion: Five values of θ of PSA: ...
  Response 6: Thank you for your suggestion. We have made the necessary modifications in the Fig. 2 and the context. (Page #4)

- Line #7: an OCA was used as a control group in the sanding tests.
  Comment: It is recommended to provide the characteristics of the OCA used as a control reference and to specify whether it is self-made or acquired from the market.
Response 7: We appreciate the reviewer’s comment. Following the reviewer's suggestion, we have included the characteristics of the OCA in the revised manuscript. The modified sentence now reads as follows:

“Additionally, an OCA with a grit size of 220 (Zhejiang Jiasheng Grinding Co., Ltd.) was used as a control reference in the sanding tests.” (Page #4)

2.3 Sanding test

- In order to better understand the choice of test bench design, it would be valuable if the authors could provide their insights on the following points:
  - Sanding direction: since the sanding belt has no rotational or unidirectional linear movement, does the sanding action take place in the forward and return movements provided by the drive system? If so, are there two sanding directions? Are there any industrial sanders using this concept?
    Response 8: The sanding action occurs during the forward movements of the sanding device, and it is a unidirectional sanding process. The drive system rotates the connecting rod, causing the sample to move back and forth. During the return process, the compression device is lifted to ensure that the sample is sanded only in one direction (forward), which aligns with the concept of unidirectional sanding used in the wood industry. And we have also included a description of single-direction sanding as follows:

    “During the return process, the compression device was lifted to ensure the sanding of the sample in only one direction.” (Page #5, Line #5)
  - Sanding speed of 0.2 m/s: is this chosen speed value because of the limitation of the drive system or is it used in industrial sanders?
    Response 9: The choice of a feeding speed of 0.2 m/s was based on both the drive system and common practices in industrial sanding. According to the relevant parameters of industrial sanders[1-2], the main feed speeds currently used range from 2.5 to 10 m/min (0.04 to 0.18 m/s), with a maximum speed of 20 m/min (0.33 m/s). The chosen speed of 0.2 m/s in the experiment falls within the range of speeds commonly used in sanders. Additionally, the choice of a relatively higher feeding speed facilitates accelerated material removal and blunting of the abrasive belt within an appropriate range, thereby enhancing the study of the sanding performance of the new belt.

Reference


- Sampling: as the number of MDF samples per test is not clearly stated, it is
preferable to indicate the number of samples for each test configuration, and to justify the relevance of the chosen number of samples.

**Response 10:** We acknowledge the reviewer's comment. “To minimize the potential impact of density variations in the thickness direction of MDF samples, a new sample was replaced every 5000 sanding times. A total of 30 MDF samples were used for each sanding experiment.” And this information has been added in Section 2.3. (Page #5)

2.4 Characterization techniques
2.4.1 Mass variation
- **Line #6:** to clear wood debris on the surface of the samples …
  
  **Suggested correction:** to clear wood debris from the surface of the samples …

  **Response 11:** Thank you for your suggestion. We have made the modification in Section 2.4.1. (Page #5)

2.4.2 Topography and surface roughness

3 Results and discussion

3.1 Material removal efficiency
- **Page #8,** under Table 3: Rake angle affects cutting force and chip formation (Wu et al. 2022).
  
  **Comment:** The effect of cutting angle on cutting forces and chip formation in orthogonal cutting has been proven by many researchers. However, the cutting configuration, such as the cutting edge with rake, sharpening and clearance angles, and friction force in the orthogonal cutting are different from ones of sanding operation. It might be better to cite another article dealing with material removal more similar to the wood sanding configuration.

  **Response 12:** Thank you for your valuable comment. This part has been updated with references and revisions have been made in the uploaded manuscript. (Page #9)

3.2 Sanding surface quality
- **First line in page 10:** According to survey, the surface roughness …

  **Comment:** Is it possible to provide more details about this survey, e.g., when, where and by whom was the survey carried out?

  **Response 13:** Based on our surveys conducted at two wooden flooring factories (Zhejiang Yuhua Timber Co., Ltd. and Arte Mundi Group Co., Ltd.), we got the ideal surface roughness for finishing wooden materials. Furthermore, according to Chinese national standard GB/T 12472-2003, the recommended surface roughness range for wooden materials after sanding is 3.2-50 μm. We have made modifications and additions to the content of the
3.3 Failure of PSA

- Line #6: …, as illustrated in Fig. 11. The angle between …
  Comment: Is there a typo in the figure number? Is figure 13 the right one?
  **Response 14:** Thank you for your careful review. We have examined the original text and have confirmed that the conclusion was derived from Fig. 11. According to Fig. 11, it can be observed that as the number of sanding times increases, the increase in mass of abrasive belt is more pronounced in the OCA. However, in order to avoid ambiguity, we have made improvements to this section of the original text. (Page #13)

4 Conclusion

- Bullet point #4: When θ became small, the friction force of abrasive debris and chips along the chip removal channel decreased.
  Comment: According to the previous paragraph, when θ decreases, dFma increases. Isn't that contradictory with the statement in bullet point #4.
  **Response 15:** Thank you for your careful review. We apologize for the error and have made the necessary corrections. Additionally, we have carefully reviewed and modified the entire text.