

Contribution Details

ID:5251

Title: Novel processing of Microchannels in Micro Grinding with Automated Laser-Assistance

Dear Editor and Reviewers,

I hope you are doing well.

I would like to thank you for reviewing the manuscript entitled “Novel processing of Microchannels in Micro Grinding with Automated Laser-Assistance” and giving valuable suggestions to improve manuscript content. Authors have tried to incorporate reviewer’s suggestions in the manuscript and responded to comments. We would like to submit the updated manuscript and its corresponding responses for publication in IJAMT. Please review the following responses.

(Red font shows the response for comments)

(Suitable portion is highlighted in the manuscript as well)

Response to Reviewer comments

Review 1

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Comments for the Authors

This paper presents a novel hybrid micro grinding method using a micro pencil grinding tool for microchannel fabrication.

- In the abstract, a sentence on the global context before focusing on the topic could increase the quality of the paper.

Response: Abstract has been modified to include global context now.

- In the introduction, the references have to be presented according to their use in the text.

Response: References have been modified and updated accordingly.

- The introduction has to be improved by checking references, but also spaces between references and the text.

Response: The introduction has been revised to enhance its quality by ensuring proper referencing and appropriate spacing between references and the text.

- Links between paragraphs have to be done for increasing the consistency of the introduction and to clearly show the position of the paper in the literature.

Response: The consistency of the introduction has been enhanced by appropriately linking paragraphs to clearly demonstrate the paper's position in the literature.

- Please pay attention to space in all the paper (example : [13].While...)

Response: Spacing errors have been carefully reviewed and corrected throughout the paper.

- The section on method seems well structured. The paper has to respect a classical structure by introducing subsections.

Response: Thank you, subsections have been added as necessary to ensure that the paper adheres to a classical structure.

- Pay attention to mistakes (example “rate..”)

Response: Mistakes have been removed after reading carefully throughout the manuscript.

- Sentences are required for link all subsections of the section 3. The link with each concept of the section 2 has also to be done.

Response: Sentences have been added to link all subsections of section 3. Additionally, connections with each concept of section 2 have been established.

- The results obtained seems good. The structure of the conclusion could be increased by eliminating bullet and more developing each point that has been presented above.

Response: The conclusion section has been re-written to reflect this suggestion, bullets have been removed, a paragraph-based approach has been adopted to describe the concluding points.

Review 2

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Comments for the Authors.

- The literature review that is included in the introduction section is extensive, however the structure of the review (literature topics that have been investigated), are not stated clearly. You can either present it at the begin of the review, or state the topic of every paragraph at the begin.

Response: The introduction section has been revamped in light of this suggestion, clarity on review structure is now given.

- At the Experimentation chapter, a figure with the toolpath of the MPGT and the laser for the two patterns on the test part is needed.

Response: A new figure has been added in this section which is now Figure 4: Toolpath of the MPGT and laser pattern on the test part.

- Figure 4 shows that for the experiments with 30W laser power, the forces start to increase again. The explanation of this phenomenon is not discussed in the manuscript.

Response: This is now Figure 5, The life of MPGT tool is due to cantilever nature and wear is significant. As the same tool was used during experimentation, the tool has undergone wear because of which at 30W of laser power there is minor increase in cutting force as the abrasive grains get loose after a considerable length of machining. This results in the minor increase in F_z and F_y .

- The second and third bullets of the conclusion chapter are stating the exact same thing.

Response: The conclusion section has been re-written to reflect suggestion from Reviewer 1, bullets have been removed, a paragraph-based approach has been adopted to describe the concluding points.

- It is suggested that the use and review of works similar to the following ones could be beneficial for the authors:

Response: The suggested references have been useful to better describe the literature, these have been added to the manuscript.

Review 3

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Comments for the Authors

- This manuscript attempts to present novel processing of microchannels in LAMG and investigate the effect of various parameters, namely laser input energy densities and laser power, on cutting forces and surface roughness on both the tool and the work surface with two distinct scan patterns. However, the novelty of the work presented, which has been mentioned in both the title and abstract, is not clearly articulated. While the paper mentioned "novel processing" in the title and "novel laser assistance scan patterns in the abstract, it would be beneficial to explicitly state what makes the methodology or findings of this study unique compared to research done so far.

Response: The abstract and the introduction section have been revised and the novelty aspect has been clearly and explicitly described in the revised sections.

- Additionally, the detailed results provided in the Abstract without sufficient explanation about the method and patterns do not help understand the value of this manuscript.

Response: The explanation regarding the method has been included in the abstract which now reflects the value and context of the results provided.

- In the introduction section and throughout the manuscript, almost all of the cited papers were published before 2019, excluding two or three weeks. This raises questions about the comprehensiveness of the currency of the literature. A more thorough literature review would enhance the quality of the manuscript.

Response: New and recent literature references are now included as suggested by Reviewer 2 to include recent developments in the field. However, the previous references have been kept as they do add value and are very relevant to the work.

- Furthermore, in the materials and Methods section, there is a lack of details on the experimental setup. While the experimental machining system (AMMS) is described, limited

detail is provided regarding the specific configuration and capability of the system, information about the precise configuration and capabilities of the system. Information about the precise configuration of the CNC micromachining system, particularly its suitability for conducting LAGM experiments, would be very helpful for replicating the experiment and comparing be results.

Response: This has been further described now in Section 2.1, the same explanation is as follows:

LAMG was performed on the Advanced Multi-Process Micro Machining System (AMMS), a versatile 5-axes CNC micromachining system developed at IIT Delhi [33] [14] as shown in Fig 1. AMMS includes various variants of high-speed tool machining, LBM, and EDM. It encompasses micro-machining processes such as micro-drilling, micro-milling, and micro-cutting, utilizing both conventional and non-conventional methods. AMMS, has linear positioners with 1 μm precision, utilizing linear motors for the positioning of axes on precise granite bed. It has A & C axis which makes capable for 3D Jobs. AMMS offers high accuracy and repeatability, enabling precise movement for high accuracy microcomponents. AMMS offers high accuracy and repeatability, enabling precise motion for microcomponents with closer dimensional tolerances. AMMS is developed on vibration-damped granite bed, providing a stable foundation that minimizes any unwanted vibrations during machining operations. This setup ensures optimal conditions for high-precision micro machining processes.

AMMS has a LBM tool which having a nanosecond fiber laser (SPI G4 EP-Z 50 W) (Table 1) with a Precitec cutting head to capable for microfabrication and structuring [12][16]. The laser beam is precisely focused on the work surface with a constant 0.2 mm gap between the nozzle and the workpiece's top surface at the focal point. A high-speed aerostatic bearing spindle (Nakanishi NRAF 5080 with E3000 controller) on AMMS enables high-speed micro grinding after laser structuring in a single setup in automated manner. The laser-to-grinding tool distance is 98.1mm. After laser structuring, the micro-grinding tool moves at 50 mm/s to create channels in an automated process (programmed path), first using laser machining with air assisted and then micro pencil grinding.

It must also be noted that the detailed explanation for AMMS can also be found in the reference 33 that has now been cited.

- Additionally, the description of laser structuring parameters lacks clarity. For example, while pulse energy and pulse repetition rate (PRR) are mentioned, other critical parameters such as spot size and dwell time are not specified.

Response: These parameters are already detailed in Table 1 of the manuscript.

- Furthermore, the paper does not detail how the value of different parameters were determined to achieve best results. It would be beneficial to explain if any Design of Experiments (DoE) such as factorial design, mixture design, or Taguchi array design were utilized.

Response: The primary focus of the paper is on introducing and establishing novel methodologies. While the author has indeed worked on optimizing process conditions, due to the manuscript's limited length, a detailed discussion on this aspect will be provided separately in different manuscript simultaneously. The optimization study by itself is equal to the length of this paper itself, that study merits a separate publication.