Dear Reviewer:

Thank you very much for your help in processing the review of our manuscript (Manuscript ID: processes-2708268). We have carefully read the thoughtful comments from you and found that these suggestions are helpful for us to improve our manuscript. On the basis of the enlightening questions and helpful advice, we have now completed the revision of our manuscript.

Manuscript ID: processes-2708268
Manuscript Type: Article
Title: " The Effect of MoS_2 and MWCNTs Nanomicro Lubrication on the Process of 7050 Aluminum Alloy"

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Sincerely,
Mr. Zhang

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Comments 1:

The introduction still lacks structure. For instance, page 3 of 15, it was written "Hence, different mass fractions of MOS_2 and MWCNTs nano-particles are combined with soybean oil."

Comment: That would have been necessary if the aim of the study is to check comparatively the features of MOS_2 and MWCNTs. Please, rearrange or delete it. Discuss the main characteristics of the MOS_2 and MWCNTs.

Response 1:

Thank you very much for your review and valuable suggestions. Our research objective is to select the one with the best mass fraction among three types of nanofluid lubricants. We have made modifications to the second paragraph on page 4 of the manuscript. The specific modifications are as follows:

This article uses soybean oil as the base fluid, combined with multi walled carbon nanotubes with excellent thermal conductivity and molybdenum disulfide nanoparticles with excellent lubrication performance, to prepare three types of nanofluids: MOS_2 nanofluids with mass fractions of 0.5 wt.%, 1.0 wt.%, 1.5 wt.%, and 2.0 wt.%, MWCNTs nanofluids, and MOS_2/MWCNTs mixed nanofluids. Nanofluid assisted milling experiments were conducted on 7050 aluminum alloy to evaluate the effects of nanofluid on cutting force F, cutting temperature ℃, and surface roughness Ra. A nanofluid with significant lubrication effect was selected and 16 orthogonal milling experiments were conducted to obtain an empirical formula for cutting force. The multi-objective genetic algorithm and TOPSIS comprehensive evaluation method were used to optimize various parameters, providing important reference value for practical nanofluid micro lubrication milling machining.

Comments 2:

There is a need to restructure the introduction section; concept definition, theoretical review, and empirical review could be easily fetched. Note that each paragraph should announce at least an important study concept. Recall that the major components of a standard paragraph under the introduction are (a) The definition of the term/concept/idea is needed to understand the exact contribution of the report to the body of knowledge. (b) The theoretical review tells us about the published aim and significant theory. (c) The empirical review tells us about published results within the scope of the subject matter. Because of this, there is a need to revise the entire introduction. However, ensure that each paragraph reflect the definition of the term/concept/idea, theoretical review, and empirical review of the results most related or useful in the study.

Response 2:

Thank you very much for your review and valuable suggestions. We have carefully considered your suggestions regarding the introduction section and made corresponding modifications. Here is our reorganized introduction:

Milling is a commonly used processing technology in modern manufacturing. Aluminum alloy is known for its low density, high strength, high temperature resistance, and sturdy load-bearing capacity, and has become a key material for manufacturing important structural

components in the aerospace industry[1-2]. During the milling process, accompanied by intense friction and heat release, if not cooled in a timely manner, it can cause local temperatures to be too high, resulting in thermal damage to the surface of the workpiece[3]. Traditional pouring cooling processing of aluminum alloys often leads to problems such as excessive cutting force, severe tool wear, and poor surface quality of the workpiece[4-5]. The chemical additives contained in traditional coolant not only pollute the environment, but also pose a threat to workers' health. Therefore, finding an efficient and environmentally friendly cutting fluid and processing method has become particularly important.

As a near dry processing technology, micro lubrication (MQL) can effectively protect the environment and worker health. According to reports, compared to traditional pouring lubrication, MQL can reduce human toxicity by 87% and slow down the global warming trend by 21%. Compared with dry cutting methods, micro lubrication can improve the surface quality of workpieces[6-9]. Khettabi et al. investigated the MQL and dry milling properties of 7075, 6061, and 2024 aluminum alloys. They found that MQL milling can reduce cutting force and improve surface finish[10]. Micro lubrication uses environmentally friendly vegetable oil and animal oil as lubricants, which will not cause pollution to the environment. Due to the high temperature and high speed involved in processing certain materials, traditional vegetable and animal oils often undergo oxidation, thereby reducing the lubrication effect during high-speed and high temperature processing. According to reports, adding nanoparticles to basic animal and vegetable oils can further enhance the thermal conductivity of the base fluid, improve its lubrication ability, and have no harm to the environment[11].

Singh et al. elaborated on the research progress of nano cutting fluids. Research has found that compared to dry and traditional wet lubrication machining, the use of MQL technology with the addition of nanoparticles can significantly reduce cutting force and cutting temperature, while improving surface quality[12]. Albert et al. added graphite nanoparticles to the base solution and subsequently ground D-2 tool steel. Compared to traditional MQL grinding, this reduces grinding force and improves surface quality[13]. Rahmati et al. compared the surface quality changes during the milling process of AI6061-T6 alloy and evaluated the effects of using mineral oil and adding different mass fractions of MOS_2 nanoparticles on lubrication performance. The research results show that lubricants containing the minimum amount of MOS_2 nanoparticles perform better in improving surface quality compared to mineral oils[14]. Anuj et al. configured multi walled carbon nanotubes and Al nanoparticles into cutting fluids with 0.25%, 0.75%, and 1.2% mass fractions, and subsequently conducted AISI 304 stainless steel turning experiments. As the mass fraction increases, the lubrication performance of the cutting fluid gradually improves significantly. Compared to a single Al nanofluid, the mixed nanofluid has a certain reduction in tool wear and peak processing temperature, which are 11% and 27.36%, respectively[15]. Sharma prepared a nanofluid cutting fluid using carbon nanotubes (CNTs) and conducted turning experiments on AISID-2 steel. The results showed that the temperature in the cutting area decreased significantly[16]. Aref added different qualities of MoS_2 and CuO nanoparticles to rapeseed oil and soybean oil, and ground AISID-2 tool steel. The research results show that adding 4% CuO nanoparticles and 2% MoS_2 nanoparticles to soybean oil can reduce the normal force of soybean oil by 19% and the tangential force by 35%[17]. Guan et al. proposed the use of a composite filled with oleic acid inside multi walled carbon nanotubes to prepare nanofluids. Compared

to ordinary multi walled carbon nanotubes, the composite filled with oleic acid has better heat transfer and wettability within the multi walled carbon nanotubes[18].

Multi walled carbon nanotubes(MWCNTs) are nanotubes formed by winding multiple layers of graphite sheets around the centerline, with a hollow inner cavity structure inside[19]. The thermal conductivity of multi walled carbon nanotubes can reach 6kW/(m·k), which inherently has good lubrication properties and can play a role similar to "micro bearings". Therefore, multi walled carbon nanotubes are suitable as additives for cutting fluids[20]. MOS_2 nanoparticles have a layered structure, formed by covalent bonding between sulfur and molybdenum atoms, forming a hexagonal crystal structure[21-22]. The MOS_2 molecular layers are connected to each other through weak van der Waals forces, which endow MOS_2 with flexible structural By sliding the molecular layer, it can transform to the dual surface to form a transfer film, endowing MOS_2 with the characteristic of reducing friction.

This article uses soybean oil as the base fluid, combined with multi walled carbon nanotubes with excellent thermal conductivity and molybdenum disulfide nanoparticles with excellent lubrication performance, to prepare three types of nanofluids: MOS_2 nanofluids with mass fractions of 0.5 wt.%, 1.0 wt.%, 1.5 wt.%, and 2.0 wt.%, MWCNTs nanofluids, and MOS_2/MWCNTs mixed nanofluids. Nanofluid assisted milling experiments were conducted on 7050 aluminum alloy to evaluate the effects of nanofluid on cutting force F, cutting temperature ℃, and surface roughness Ra. A nanofluid with significant lubrication effect was selected and 16 orthogonal milling experiments were conducted to obtain an empirical formula for cutting force. The multi-objective genetic algorithm and TOPSIS comprehensive evaluation method were used to optimize various parameters, providing important reference value for practical nanofluid micro lubrication milling machining.

Comments 3:

Table 3 is about properties of proposed nanoparticles. From where these properties have been taken. Please provide citation to Table 3.

Response 3:

Thank you very much for your review and valuable suggestions. Regarding the sources of obtaining the properties of nanoparticles mentioned in Table 3, we will provide corresponding references in the revised version and ensure that the attributes in Table 3 have clear sources. The attributes of Table 3 are sourced from the reagent manual published by Shanghai Science and Technology Publishing House.

Comments 4:

There is a need first to present the analysis of results. One common fact in almost all the quality publications within our field is the presentation of the analysis and discussion of results. Meanwhile, the best practice is to build the discussion of results on the results that have been analyzed. This will guide the authors to present the best and most accurate results capable of announcing the title and lead to conclusive facts in the next section of the manuscript. Nevertheless, the authors should note that the analysis of results is quite different from the discussion of results. The results section should aim to narrate the findings without trying to interpret or evaluate and provide a direction to the discussion

section of the research paper. Finally, the results are reported and reveal the analysis. The analysis section is where the writer describes what was done with the data found. Comment: The authors must separate the analysis of results from the discussion of results. Introduce two subsections named: Analysis of Results and Discussion of Results.

Response 4:

Thank you very much for your review and valuable suggestions. We have carefully considered your guidance and will make adjustments according to your suggestions in the revised version. Due to the fact that the revised version occupies the majority of the content, it is not detailed here. Please refer to Chapter 3 on page 9 of the manuscript for detailed modifications.