# Author’s Response to the Review Comments

***Journal* : Jurnal Elektronika dan Telekomunikasi**

*Title of Paper* : Optimization of Titanium Dioxide Nanoparticles in Mesoporous

Electron Transport Layer Perovskite Solar Cell

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We appreciate the time and efforts by the editor and referees in reviewing this manuscript. We have addressed all issues indicated in the review report, and believed that the revised version can meet the journal publication requirements. We have included the line numbers in the revised manuscript to help the reviewers identify our changes.

| **Comment** | **Response** | **Location of Response in Revised Manuscript** |
| --- | --- | --- |
| **REVIEWER B COMMENTS** |  |  |
| Please clearly state the novelty of this project in the introduction | We have added these points to the introduction in accordance with this recommendation. | *Section: Introduction paragraph 4* |
| More discussion should be given in Introduction since there is no more strong statement about TiO2 as electron transport layer or their preparation process was state in Introduction. | We have added these points to the introduction in accordance with this recommendation. | *Section: Introduction paragraph 4* |
| The statements of mass ratio are vague because statement mass ration in Introduction, Procedure and Results is different. Please clearly state the mass ratio is refers to the concentrations of opaque between transparent TiO2 nanoparticle or mass ratio between ethanol with TiO2 nanoparticle? | We have added these points to the introduction in accordance with this recommendation | *Section:*  *Introduction paragraph 4 (last sentence), Experimental Section (Part B. Procedure in paragraph 2) and Results* |
| The main idea of this research is optimization of titanium dioxide nanoparticle, however the detailed discussion regarding preparation process of TiO2 nanoparticle is not clear, for example how much the volume of solutions were spin-coated on the substrates or the amount of TiO2 layer deposited on substrate or after preparation of TiO2 with certain mass ratio the sample need other preparation process or further treatment before deposited with spin coating method? | We have added these points to the introduction in accordance with this recommendation | *Section:*  *Experimental Section (Part B. Procedure, paragraph 3)* |
| No much review on the advantages and different between opaque or transparent TiO2 nanoparticle as electron transport layer More discussion should be given in result and discussion related to the correlation between results from each characterization with the performance of the sample. | We have added these points to the introduction in accordance with this recommendation | Section:  Introduction (paragraph 4) |
| Overall, not much different the resulting efficiency from opaque or transparent TiO2. Please clearly identify | The efficiency of transparent TiO2 is 2 times greater than opaque | Section:  No revision made |
| Please enlarge the figures 8 in the manuscript, so we could observe the I-V characteristic of the sample for better analysis. | We have made improvements to the figure | Section:  Figure 8 |
| How about the recycling of this material? | TiO2 paste material used as initial material after under heat treatment at 500 oC cannot be recycled because it will affect the surface of the resulting perovskite layer | Section:  No revision made |
| The references are not up to date. They should be in the last five years. | We have replaced the references with the latest ones | *Section:*  *References* |
| **REVIEWER E COMMENTS** |  |  |
| The authors need to provide more explanation on the last paragraph of the Introduction, as to:  (a) Why they used two types of titania, i.e. opaque and transparent?  (b) Why the nanoparticles were diluted (why don’t just used the original composition)?; and  (c) Why the weight compositions of 1:3, 1:5, 1:7, 1:9, and 1:11 were chosen, and in particularly, why the authors did not compare them with the original composition/pure TiO2 paste only (1:0)? | We have added the explanation | *Section: Introduction (paragraph 4)*  *and Experimental Section (Part B. Procedure, paragraph 2)* |
| Last paragraph in section III.B: Not sure what the “scatter particles” refer to. Are they the particle aggregates that appear on the film surface? The term “scatter particles” needs to be explained further. I disagree with the statement “high solvent ratio would lead to homogeneous particle size”. The authors need to know the difference between particle and aggregates. In the authors’ work, ethanol is only used as dispersant. It was not exactly used as “solvent” because the definition of solvent is to dissolve. Thus, the various ratio of ethanol used in the authors’ work would only basically affect the dispersion of TiO2 nanoparticles, hence, films with different agglomerations (not particle size) were obtained. The use of ethanol would only affect the particle size when it is used as solvent during the nanoparticle synthesis, for example during sol-gel reaction, but not when it is used as dispersant.. | We agree with reviewer that the use of the term dispersant is deemed more appropriate when compared to solvent. Therefore we have replaced “solvent” with “dispersant” | *Section: Manuscript* |
| How was the film thickness measured and the authors determine the error bars? No information was given in the experimental section. | We have added the explanation | Section:  Discussion (paragraph 3) and Figure 4 |
| Figure 5a: how come the control sample has lower transmittance compared to the rest of the samples that have more layers? The transmittance data on this graph (especially in visible region) also seems to be quite random and no correlation between transmittance and solvent ratio could be observed. Please explain this phenomenon. | Figure 5a has been changed to figure 6a, and the the explanation has been added. | Section:  Discussion (paragraph 6) and Figure 6a |
| Figure 6: please explain why the conductivity of transparent TiO2 especially with 1:11 ratio, is significantly higher than opaque TiO2 even though the thickness for both samples are not that much different (in Figure4). | Figure 6 has been changed to figure 7. | Section:  Discussion (paragraph 7) and Figure 7 |
| Please provide more explanation why the highest PCE was obtained from the transparent TiO2 sample with 1:7 ratio? | We have added the explanation | Section:  Results and Discussion (Paragraph 9) |
| Please explain why the FF values in this work are very low (<0.1)? | We have replaced the FF value because the previous value was wrong calculation | Section:  Table 2 |
| **REVIEWER A COMMENTS** | | |
| Revising the following statement: “The quality of the ETL can be improved by controlling both layer thickness and morphology. ETL thickness is very influential on the ease of electrons to flow to the anode, (prevent recombination) and the optical properties of cells [12]” in paragraph 4 of the introduction section. The use of brackets in this sentence is unnecessary and inaccurate. | We have changed and corrected the statement. | Introduction paragraph 4 (line 18-20) |
| Moving the highlighted part in the Introduction section into Results and Discussion or in the earlier part of Introduction. The last part of Introduction is typically filled with justifications of the importance, objectives, or state-of-the art of the proposed study. | We have moved the paragraph (calculating Voc theoritically) into the first part of Results and Discussion section. | Results and Discussion (paragraph 1) |
| Please add more specific information on the Author Response form to indicate the locatuons of the revisions. | We have added more specific location of the revised part. |  |
| Making sure all references have strictly followed the journal requirement. Journal names are still not written in abbreviations and not all are written in italics. | We have revised the writtten reference into the correct journal requirement | References |