Response to Reviewer 1 Comments

Dear Reviewer,

Thank you very much for carefully review and constructive comments on our manuscript entitled “Tuning the doping ratio and phase transition temperature of VO₂ thin film by dual-target co-sputtering” (Manuscript ISSN 2079-4991). We studied the comments carefully and tried our best to revise and improve the manuscript according to your comments. The point to point response to your comments are listed as following:

**Point 1:** There are statements about numerical results that have no error bars. No statement about the number of trials is given. Compositions, results etc are given with high precision and significant digits without justification. This paper MUST include error analysis to be published. The presentation of a method to make a specific material must contain the limits on the fabrication method.

**Response 1:** Sorry for negligence of error analysis. We have modified them in the text according to your comments. For example, we analyzed the signal-to-noise ratio (SNR) of the test spectrum for the test error. It is larger than 10000 for all the spectral measurements and is good enough. The diffraction peaks of XRD results agree with the standard cards well. The largest deviation of 1.4% comes from the first peak of V₂O₅ at 12.404 degree from the standard card. The error of sputtering power deviation is less than 340 V ± 5 V and corresponding to maximum error of 1.5%. All mentioned above have also been added into the corresponding parts of the manuscript.

**Point 2:** Line 29 and others. Do not use adjectives such as "huge" "large" etc. They have no place in scientific writing. If you have a range, give the numbers and a reference. Same for lines 38 "very low", 41 "very difficult"..and so on.

**Response 2:** We have made the corrections according to your comments.

**Point 3:** Line 44: titles are not used in references. Delete "Dr,"

**Response 3:** We deleted "Dr," according to your comment.

**Point 4:** Line 54: you do not include any cost estimates or cost data.. Delete "cost is too high".
Response 4: We deleted "cost is too high" according to your comment.

Point 5: Line 61: "room temperature is not a scientific concept. Use the actual temperature.

Response 5: The room temperature is usually default as 25°C. But in the manuscript, we use it to express the meaning of “without heating” during the sputtering process. So we substitute “room temperature” for “without heating”.

Point 6: Line 78 "planar"?

Response 6: We substitute “plane” for “planar” throughout the manuscript according to your comment.

Point 7: Line 87: "coating power”? "500 W with increasing step of 100 W per minute” What does this mean? Was the power increased?

There is a paper that suggest the sputtering power changes the transition temperature. What evidence do you have the sputtering power does not cause the change in transition temperature? (Infrared-light switching in highly oriented VO2 films on ZnO-buffered glasses with controlled phase transition temperatures. By:Hoshino, H (Hoshino, Hiroaki)[ 1 ] ; Okimura, K (Okimura, Kunio)[ 1 ] ; Yamaguchi, I (Yamaguchi, Iwao)[ 2 ] ; Tsuchiya, T (Tsuchiya, Tetsuo)[ 2 ].SOLAR ENERGY MATERIALS AND SOLAR CELLS.Volume: 191,Pages: 9-14,DOI: 10.1016/j.solmat.2018.10.022)

Response 7: Sorry for the ambiguous expression. What we want to express is that the sputtering power is set as 500 W when coating the V film, which is increased from 0 W to 500 W at a rate of 100 W per minute before coating. The sputtering power does not change during the coating process. Since the fabrication approach is different from that of the reviewer provided, which contains two procedures for fabrication of VO2 film. V metal film is sputtered firstly and then annealed and oxidized to be VO2 film. What sputtered is V metal film (not VO2 film), whose sputtering power does not influence the transition temperature at all. Therefore, our fabrication approach is easy to be controlled and the repeatability is higher than those approaches sputtering the VO2 film directly.

Point 8: Lines 93 to 98 these are the expected compositions, were they verified?

Response 8: The compositions are expected and were not verified. We inserted "supposed to be" between "the deposition ratio of V and W-doped V is" and "2:0, 2:1, 2:2, 1:2, 0:2".
**Point 9:** Line 114 ??? "The total....speed". Makes no sense.

**Response 9:** It should be misunderstood here due to the vague expression of “times” and “time”. For the sputtering system we used, the substrate was put on the conveyor and moved backward and forward underneath the targets to increase the homogeneity during sputtering. We defined that when the substrate moves backward and forward underneath the targets once as one sputtering cycle. Therefore, the thickness of each sputtering cycle was deduced from the SEM measured thickness of five sputtering cycles. We modified the related expression in the context.

**Point 10:** Line 129. It is a good practice to separate results from discussion. The discussion on lines 130 onward is speculation and does not belong in a results section.

**Response 10:** Thank you for your suggestion for dealing with results and discussion. However, it is very difficult to separate results from discussion, since the results need proper explanation or reasonable speculation after them for readers to better understand them.

**Point 11:** Figure 2: The scale bars are too small to be seen in the figures.

**Response 11:** We have re-drawn Figure 2 with larger scale bars according to your suggestion.

**Point 12:** Figure 3: reference marks for peaks of standard compounds are usually shown to orient thereader. The V₆O₁₁ peak is small, are there any other peaks? How are the compositions determined to such precision? V₀.₉₈ W₀.₀₂ O₂ ±/-%? Also in line 149.

**Response 12:** We have re-drawn Figure 3 according to your comment. No peaks other than V₆O₁₁ and V₂O₅ were found from the XRD analysis. The composition of V₀.₉₈W₀.₀₂O₂ was ensured from the target with V: W ratio of 98:2 we ordered.

**Point 13:** Line 151; how are the percentages calculated, what error?

**Response 13:** The percentages of W in VO₂ were calculated from the sputtering power ratio of V target and W doped V target which were set as 500 W :0 W, 500 W :250 W, 500 W :500 W, 250 W :500 W, 0 W :500 W, respectively. The error comes from the power deviation which is less than 340 V ±5 V and corresponding to maximum of 1.5%.
**Point 14:** Figure 4: Error bars? Significant figures? How reproducible is this data.

**Response 14:** Signal to noise ratio (SNR) is used to evaluate the error level of spectrum rather than error bars, which is a common way in the field. The larger of SNR, the smaller of error. It is larger than 10000 for all the spectral measurements and good enough.

**Point 15:** line 174: How did you determine the W0.01?

**Response 15:** The W0.01 was deduced from the sputtering power ratio of V target and W doped V target, as mentioned in point 13.

**Point 16:** Figure 6 Error bars? in b).

**Response 16:** Since the phase transition temperature are calculated from the spectra and the main purpose of Figure 6 (b) is to provide the change and reveal the trend of phase transition temperature with W doping ratio, the error bars are difficult and not necessary to be provided in the figure.

**Point 17:** Line 219. You have made no cost estimates. Delete this claim.

**Response 17:** Although we have not made cost estimates, we fabricated a series of VO₂ samples with different doping ratio without adding any targets. At least the cost of three targets with doping ratio of 0.5%, 1% and 1.5% and size of 300 mm ×140 mm has been saved. More cost can be saved if more samples with other different doping ratio to be fabricated. Therefore, the claim of cutting cost using co-sputtering approach to fabricate different doping ratio is reasonable.

We tried our best to modify and improve the manuscript according to your comments. And we used the “Track Changes” function in Microsoft Word to mark the revision, so that all the changes can be easily noticed by the editors and reviewers.

We appreciate for your constructive and helpful comments on our manuscript, and hope that the correction and response will meet your requirements.