Date:	21st August 2017
To:	Referee SAIP 2016
cc:	dejenebf@ufs.ac.za, swartHC@ufs.ac.za
From:	Jatani Ungula ungulaj@ufs.ac.za
Subject:	Revision for SAIP 2016 manuscript

Ref: ID 382

Title: **Effects of different Ga doping concentration on structural and optical properties of Ga–doped ZnO nanoparticles by precipitation reflux method**

Dear Editor/Referee,

I acknowledge the receipt of reviewer comments on my submission and do hereby undertake to revise my manuscript as directed by the reviewers.

Below is a description of all changes made in response to the reviewer

comments

A. *Introduction section*

Reference (s) inserted for:

1. Besides, research has shown that GZO has electrical and optical properties comparable to those of widely employed Indium Tin Oxide TCO and the performance of GZO TCO based DSSCs was found to be superior to fluorine-doped tin oxide based DSSCs under the same growing condition [2].
2. A number of methods for the synthesis of GZO nanopowders have been investigated [9-11].
3. "…the precipitation method offers several advantages, which include cost effectiveness, high purity, homogeneity and small crystalline size of its product [12]."

4. ***Revised sentence:*** To the best of our knowledge, this method is less reported on to synthesize GZO NPs. Proof of this statement?

The above sentence rephrased as: - "To the best of our knowledge, there are only handful of reports in the literature on the synthesis of GZO NPs using this method."

5. *PVP spelt out as*: Polyvinylpyrrolidone

6. The washed sample was dried at 60 °C in an oven for one hour and packaged into sample containers.

B. *Results section*

7. This also reveals that Ga^{3+} is plausible to reside on Zn sites in the hexagonal lattice [8]

Revised as: "This also reveals that it is plausible for the Ga^{3+} to reside on zinc sites …"

8. where, K is the shape factor, (K = 0.94), D is the crystallite size, β is the broadening of the diffraction line measured at half of its maximum intensity (rad) FWHM and λ is the wavelength…"

Revised as:

"where, K is the shape factor, (K = 0.94), D is the crystallite size, β is the Full Width at Half Maximum, λ is the wavelength…"

7. We attribute the reduced density to the formation of large grains that made some pores (proof for this)

Revised as; "We attribute the reduced density to the formation of large grains as a result of coalescence of the particles with the increase in doping concentration."

8. "In the case of doping at 5 mol. % the grain size obtained decreased, which is considered in light of the increasing number of nucleation leading to…"

Revised as; "In the case of doping at 5 mol. % the grain size obtained decreased, which could be due to increasing number of nucleation sites, leading to…"

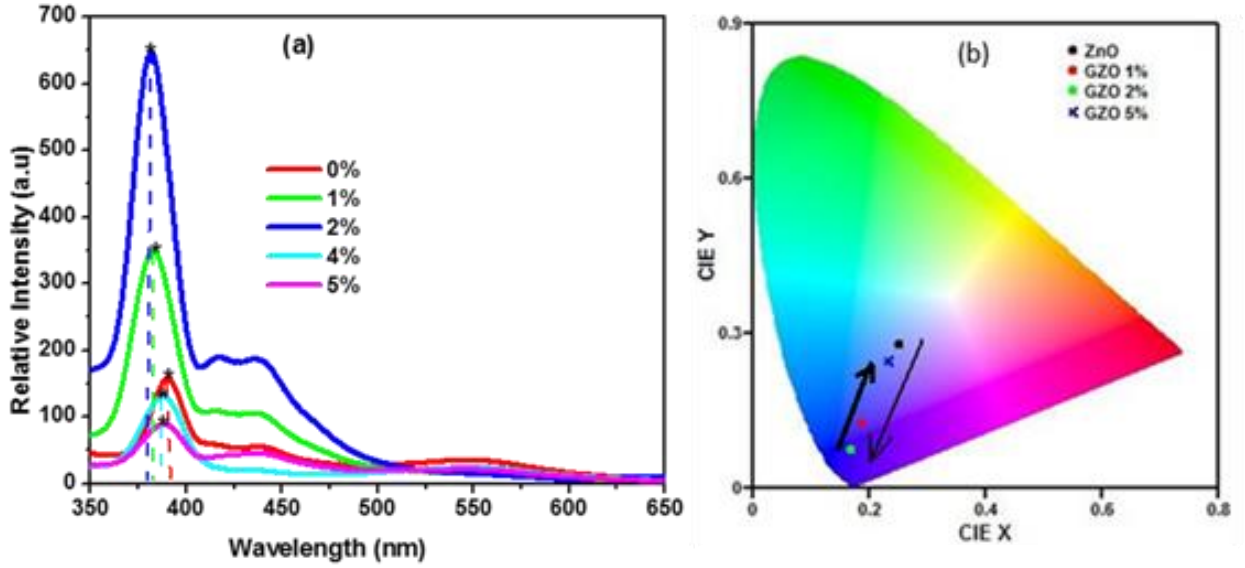
9. The EDS spectra in figure 2.2 indicate that the collected powder was composed of zinc, oxygen and Ga and the route {?} has pure ZnO phases.

Revised as below and the EDS images removed.

"The EDS images of the samples indicated that the collected powder was composed of zinc, oxygen and Ga and the synthesis route produced pure ZnO phases."

10. **Figure 3(a):** PL emission spectra and (b) Chromaticity diagram depicting the CIE colour co-ordinates for GZO NPs for the different doping concentrations.

Enlarged for visibility as shown below:



11. ***All the values of CIE results written in 3 decimal places***

The CIE (x,y) colour co-ordinates for 0, 1, 2, 4 and 5 % Ga doping concentrations are (0.25, 0.28), (0.19, 0.13), (0.17, 0.08), (0.28, 0.36) and (0.23, 0.25), respectively.

C. Conclusions and Reference *section*

12. The work in this investigation demonstrates that GZO NPs of high quality can be formed at a relatively low temperature (75 ºC) by precipitation reflux method by varying the Ga/Zn ratios.

13. The results of this work shows that a 2 mol % Ga-doped ZnO target is most suitable to obtain thin films with fairly good material properties for the use as a photo anode in DSSCs.

14. Reference [5] Jung K, Choi W K, Yoon S J, Kim H J and Choi J W 2010 *Applied Surface Science* **256** 6219.