

Reviewer Recommendation and Comments for Manuscript Number PHYSB-D-20-02379

Interpretation of the I-V, C-V and G/ω-V characteristics of the Au/ZnS/n-GaAs/In structure depending on annealing temperature

Original Submission
Oleg Ya Olikh, Ph.D. **Reviewer 1**

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Recommendation: **Major Revision**

Overall Manuscript Rating (1 - 100): 68

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Reviewer Comments to Author

Authors are bringing into community the interesting experimental results. But physical reasons of results are not discussed enough. I recommend a major revision. I have following comments.

1. The information about annealing time is absent.

2. How does the XRD pattern indicate nano crystalline nature? The peak 28.3 is not broadened enough.

3. The accuracy of parameter determination (e.g., Fig.5, Fig.8) is not specified.

4. The voltage of rectification ratio determination is not specified.

5. Using of equation $n=(q/kT)(dV/d\ln I)$ leads to dependence of ideality factor on voltage. What voltage value was used to determine the ideality factor in the paper?

6. Fig. 1(a) shows the inhomogeneity of ZnS thin film. But spatial inhomogeneity of barrier height is not discussed. For example, a change in the visible barrier height after annealing may be associated with increase in film homogeneity, rather than with metallurgical reactions.

7. On my humble opinion, the log-scale in frequency axis will be better in Fig. 8.

8. It is stated at page 9 "As can be clearly seen from these graphs [Fig.9], the measured G/ω were quite sensitive to applied bias voltage and frequency especially in the depletion region."

But it is not evident.

The reverse voltage leads to increase in depletion region, but reverse characteristics are identical for all frequencies, all samples, all voltage values.

Besides, the statement "the G/ω values depending on the frequency in D0, D1 and D2 are almost the same, in D3 the G/ω values has decreased significantly." (page 10) does not reflect a monotonic decrease in G/ω value with increasing of annealing temperature in Fig.9.

9. It is necessary to substantiate the physical mechanism of "significant changes in the concentrations of the various charges and traps at the ZnS/n-GaAs interface with thermal annealing". Generalities about metallurgical reaction, structural changes or new phases formation do not look convincing and require confirmation by experiment or reference data.

10. The main goals of paper are not clear. Why is the ZnS layer used? Has research shown the advantages of a ZnS layer over other materials?

11. The conclusion "the presence of an interfacial layer and surface states between metal and semiconductor can cause significant fluctuations in both electrical and dielectric properties" is far from original.

Reviewer Confidential Comments to Editor:

For each question, please use the following scale to answer (place an x in the space provided):

"To what extent does the article meet this criterion?"

- 0 Fails by a large amount
- 1 Fails by a small amount
- 2 Succeeds by a small amount
- 3 Succeeds by a large amount
- 4 Not applicable

The subject addressed in this article is worthy of investigation.

