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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)

Reviewer Recommendation Term:	Major Revision
Overall Reviewer Manuscript Rating:	68

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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.

0 __1 __2 _X_3 __4

The information presented was new.

0 __1 __2 _X_3 __4

The conclusions were supported by the data.

0 __1 __2 _X_3 __4

Is there a financial or other conflict of interest between your work and that of the authors?

YES __ NO _X_

Please give a frank account of the strengths and weaknesses of the article:

Strengths:

Weaknesses:

The main weakness is absence of appropriate discussion of experimental results.

The article seems raw and is a bit like a lab work report.
For example, the work contains a huge number of similar experimental curves and a small number of physically
well-grounded conclusions.

Comments to Author:

Authors are bringing into community the interesting experimental results.
But physical reasons of results are not discussed enought.
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/dlnI) 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 idendical for all frequencies, all samples, all voltage values.
Besides, the statment "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.

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