The study investigates the effects of electron irradiation on mono-crystalline silicon (c-Si) solar cells by analyzing dose-dependent degradation using a range of characterization techniques, including I-V, EQE, C-V, and G/ω-V measurements. The findings reveal that irradiation-induced defects in the base layer cause performance degradation, while the emitter and depletion edge show resilience to defect formation. Notably, significant self-healing effects and improved blue response are observed after prolonged irradiation, attributed to positive charge accumulation in the nitride layer from oxynitride formation. This work provides valuable insights into the mechanisms of radiation-induced degradation and recovery in c-Si solar cells.

While the results are intriguing, some corrections are necessary for publication, such as providing greater clarity on experimental methodologies, addressing ambiguities in the analysis of defect dynamics, and ensuring more detailed discussions of self-healing mechanisms and their reproducibility. Once these issues are addressed, the work will be a strong contribution to the field of semiconductor device reliability under radiation exposure.

Introduction

1. Line 7, the percentage should be after the figure, this error is also noticed all through the manuscript, hence the entire manuscript has to be checked to correct the mistake
2. There are few grammatical errors that needs to be corrected, for example, line 55 "it is critical to understand the behavior of the cells that exposed to ……… that are exposed instead of that exposed.
3. There is also an error due to grammar in line 27 of Pg 3. "are" is missing before well understood.
4. References about radiation studies on Si-based devices of different particle type, fluence and energy should be included. These articles can be used to report on these studies
   1. Electrical properties of 3 MeV proton irradiated silicon Schottky diodes. *Physica B: Condensed Matter* 610 (2021): 412786.
   2. Current-voltage characteristics of 4 MeV proton-irradiated silicon diodes at room temperature. *Silicon*, *14*(16) (2022), 10237-10244.
   3. Suppression of irradiation effect on electrical properties of silicon diodes by iron in p-silicon." *Radiation Effects and Defects in Solids* (2024): 1-14.
   4. Enhancing Radiation-Hardness of Si-based Diodes: An Investigation of Al-Doping Effects in Si Using IV Measurements. *Radiation Physics and Chemistry* (2024): 111873.
5. Line 53, unirradiated reads better than unexposed in this context.

Materials and Method

6. The schematic or pictorial depiction of the fabricated cells should be provided in this section.
7. The voltage range for the I-V, C-V and G/w-V measurement should be provided with the reason for the chosen range given
8. Authors should also give reason why the chosen electron doses were used (225, 450, 675 and 900)
9. It would have been more interesting to have data for more months interval, for example 12, 24, 36, 48, 60 months, this data would have given more information of how the cell performs over time.

Results and Discussions

10. The first sentence is too long and boring, it should be revised for easy understanding.
11. The statement “diode ideality factor goes to increase which indication of creation of generation-recombination level within the band gap of Si” is full of grammatical error rendering the sentence meaningless. I want to believe the authors are trying to explain the increase in the value of ideality factor after irradiation which may be attributed to the generation-recombination centers introduced by the irradiation-induced defects.
12. I suggest the results in figure 1 can be presented in a simpler form that will aid easy comparison and understanding. Two plots (a and b) for before and after irradiation with every dose plotted o a single plot.
13. The parameters evaluated for the cells needs to be explained in a better way most especially how they are obtained.
14. The caption for the figures needs to be rephrased to enhance simplicity and better understanding.
15. The parameters provided in Figure 3 are not well defined anywhere in the manuscript.
16. The C-V and G/w-V measurements were taken at a frequency of 100 KHz, however, the reason for choosing this frequency was not provided and it is very imperative.
17. The is a peak observed in the forward bias of the C-V characteristics and there is no explanation given about the observed peaks.