

To: Solid State Sciences Editorial Board
Subject: Article Submit

Dear Editors,

Enclosed with this letter you will find the electronic submission of manuscript entitled “Iron’s impact on silicon solar cell execution: comprehensive modeling across diverse scenarios” by Oleg Olikh and Oleksii Zavhorodnii.

It is widely recognized that defects can significantly alter the properties of semiconductors, and understanding the mechanisms behind these alterations is essential for optimizing solar cell efficiency. Over the years, researchers have accumulated considerable knowledge about various defects. Our investigation aims to examine the impact of iron-related defect variability on the performance of silicon-based solar cells, integrating both modeling and experimental validation.

Our research reveals that changes in short-circuit current provide the most reliable method for estimating iron impurity concentrations, significantly improving over traditional techniques. We also found that the behavior of open-circuit voltage is non-monotonic at low boron doping levels, indicating a complex interaction between doping and defect dynamics. We believe that our research not only enhances the understanding of iron-related defects but also has practical implications for developing methods to characterize impurity concentration in silicon solar cells from current-voltage characteristic. Such approach involves quantifying photovoltaic energy conversion parameters (short-circuit current, open-circuit voltage, solar cell efficiency, fill factor) and then employing these values as input features for machine learning models. One of the finding of this research is the expedience of principal component analysis in this context. Given the growing interest in renewable energy technologies and machine learning, we are confident that our findings will resonate with your readership and stimulate further exploration in this area.

This is an original paper which has not been simultaneously submitted as a whole or in part anywhere else. No elements of the work have been published in any form. No conflict of interest exists in the submission of this manuscript.

We would very much appreciate if you would consider the manuscript for publication in the *Solid State Sciences*.

Sincerely yours,
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