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Developing Perovskite Oxide Based Photovoltaics

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Developing Perovskite Oxide Based Photovoltaics

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Project Summary

By 2050 the world will require ~30 TW of power. Converting solar energy directly to electricity has been a promising research area that could potentially provide 20% of that. It has been a booming industry with market capacity over \$40 B/yr.

Photovoltaic (PV) system can convert light into electricity using photovoltaic effect. One of the most promising materials is the perovskite oxide PV cells, especially methylammonium lead halide. Methylammonium lead halide perovskite crystals can be used as a photosensitive material in mesoporous thin film solar cells. Currently, there exists potential for perovskite solar cells to reduce the cost of solar energy production via inkjet printing manufacturing, as well as expand the technology of thin film solar cells printed on flexible substrates.

This project expands on current research focused on documenting the creation of a methylammonium lead halide perovskite solar cell as described by several literatures. The entire scope of the project involves exploring a variety of commonly used solvents and application methods for the creation of mesoporous perovskite cell layers. The resulting thin film nanostructures of created cell layers can be analyzed, and average power efficiency of working cells can be used to determine the overall effectiveness of perovskite compounds for energy generation. Next steps for this research include exploring methods of inkjet printing pastes onto a substrate by modifying traditional inkjet printing technology, as well as exploring non-toxic alternatives to the lead cation in the perovskite crystal.

Student Primary Responsibilities:

- Perform catalyst performance evaluation

- Record and analyze data using standardized forms and lab notebooks
- Assist in writing reports describing procedures used
- Assure all job activities adhere to UAH Environmental, Health and Safety requirements.

Qualifications

- The ideal student for this project must be passionate about materials research for photovoltaic systems and have previous experience with similar research. The student must be familiar with lab equipment and theory behind perovskite solar technology. Mechanical skills are also recommended, particularly for focusing on details of inkjet printing manufacturing.

Mentor Supervision and Interaction

Our multi-disciplinary research group currently consists of 1 visiting scholar, 4 graduate students, 4 undergraduate researchers and high school researchers during the summer. The RCEU undergraduate student will start their everyday research activities with one of the graduate students in the group. This does not reflect any lack of interest on my part in your project; it is rather an attempt to ensure that you will always have ready access to qualified, expert advice without necessarily having to hunt me down. It is also very important that graduate students have the opportunity to develop their own mentoring skills.

Individual Meeting. A definite schedule of individual meetings and team meetings is adopted weekly in our group. The group member will meet with the mentor in an informal fashion to discuss recent progress.

Group Meeting. Our group holds weekly group meetings. The perspective student will participate in the group meeting and be able to interact with graduate students and faculty members. He/She is expected to present in the group meeting, covering literature review and research progress.

Assessment

The minimum requirement for the RCEU student is to at least present at UAH by the end of the program and submit their work to be published by the UAH undergraduate research journal –Perpetua.