Technical Assistance Request

Our team is fortunate to be based at the University of Washington, where we have access to world-class facilities through both our own department and the Clean Energy Institute. Our current progress has been realized through work in the Schlenker laboratory, which is equipped with a host of tools for the synthesis and characterization of organic molecules. We have also made use of facilities such as the Molecular Analysis Facility and the Research Training Testbeds, with the latter being particularly important as we explore the application space of photovoltaics – the RTT is equipped for in-house fabrication of photovoltaic devices made from a variety of active materials. We have also had the benefit of working with UW CoMotion, who have helped us navigate the processes of IP protection and technology transfer. While we will undoubtably continue to use these facilities in the future, we will have different needs as we continue to push our solution forward.

Near-term goals: developing new molecules

For our initial goal of developing new derivatives of our molecules, there are several tasks that must be undertaken: first, we must use some means to design and select appropriate candidate molecules that absorb in our window of interest, next, we must synthesize the molecules, and finally we must characterize them and ensure they have our desired properties.

The first task of molecule design and selection can be accelerated using predictive methods and computations. We have an active collaboration going to try and use data mining to identify possible donor moieties for our molecules, as well as to develop a machine-learning model to screen the potential candidates. However, comprehensive databases of organic molecules can be difficult to find, especially when one has specific molecular properties in mind. A large database on the donor strength of organic molecules would be an extremely valuable tool to aid us in this process.

We are currently well-equipped to synthesize our target organic molecules in house, but our synthetic efforts could be accelerated through automation. We would be able to generate and screen larger quantities of target molecules if we could automate the process with, for example, liquid-handling robots and microwave reactors.

For the final task of characterizing the molecules we make, we mainly require access to spectroscopic instruments that allow us to monitor the spectral signatures and kinetic evolutions of excited states. We already have access to such a facility at the University of Washington, but our understanding of these states could be enhanced by spectroscopic methods that explore ultrafast interactions between vibrational and electronic states.

Long-term goals: scaling our solution

A major priority as our project advances will be scaling up the production of our solution. This means large batch processes for producing molecules and extruding rolls of film. Our molecules are synthesized through a condensation reaction similar to the production of indigo dye, so we hope to translate existing industrial processes in order to scale up our dye production. Access to reactors and engineers knowledgeable in large-batch chemical processing would certainly assist us in this endeavor. For film production, there are several instruments available through the Washington Clean Energy Testbeds, such as slot-die coaters and roll-to-roll printers, that would allow us to test our film production methods at increasing scales. With the Washington Clean Energy Testbeds based at our home facility, this seems like a natural partner to explore our production process. The Testbed facilities would work well for a pilot program, but as we explore larger and larger scales we will need facilities that can process larger batches of films. It would be incredibly helpful to interface with materials engineers who have experience in the extrusion of plastic films.

We will also need to be able to test environmental factors on our films to track their long-term stability. Environmental chambers would be helpful to these efforts, as would any opportunities to place our materials out in the field and monitor the effects in real time. For any product interfacing with a solar panel, it is important to have long-term stability to match the long warranty of the product. The panel will also be outside and exposed to the elements, so making sure our materials are well-protected and stable in environmental conditions will be important in attracting industry partners.