Spatially-dependent evolution of the electronic properties of organic photovoltaic systems & marketing based education in Seattle

CHE 0725139

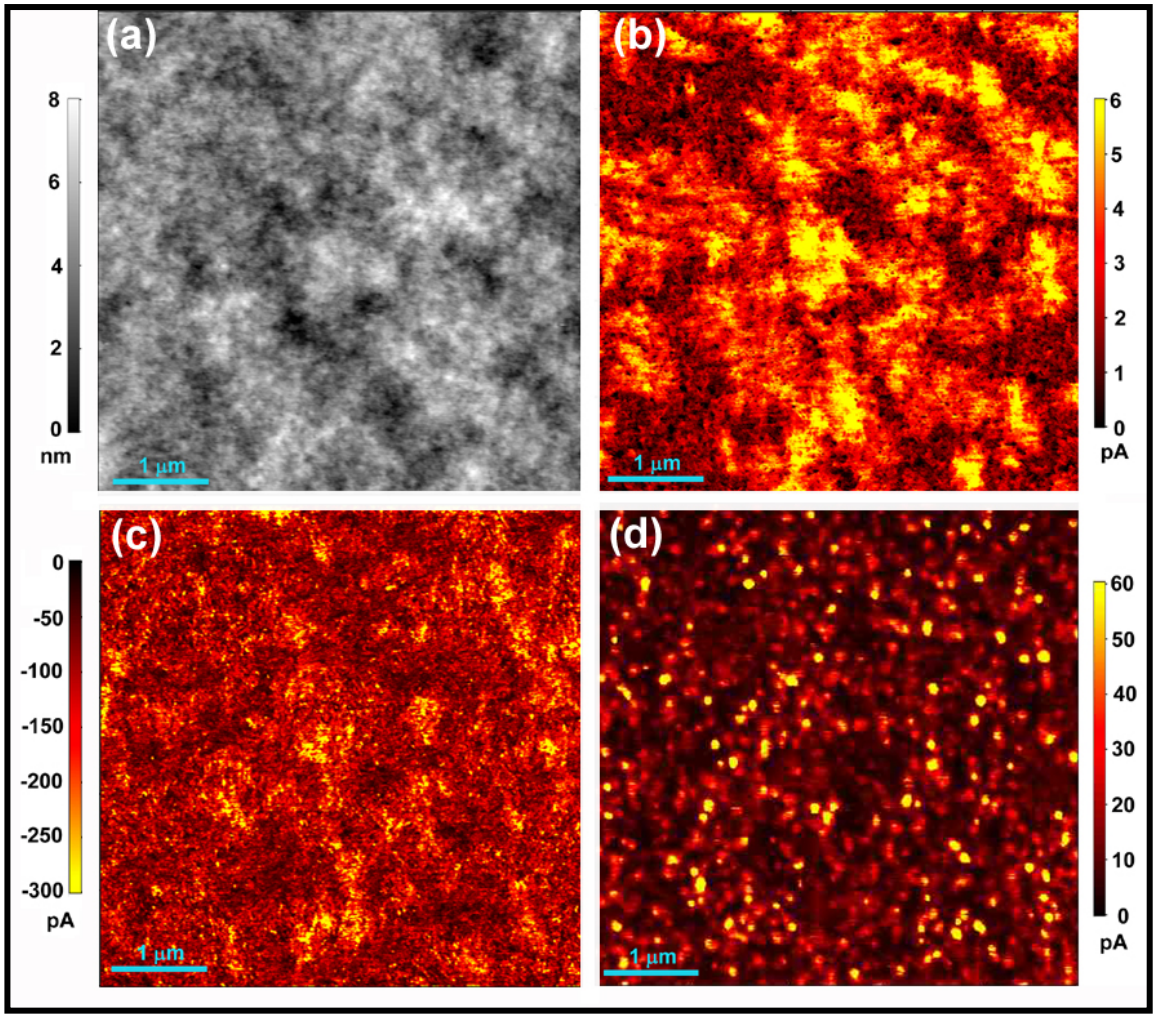
PI: Liam S.C. Pingree

Research Objectives: Examine how processing parameters affect the local electronic properties of polymer-based solar cells with new scan-probe microscopy techniques. Apply these results to engineer improved polymer-based solar cells, rather than proceeding with current trial-and-error development methods. The long-term goal in this overarching area of research is to manufacture ultra-cheap, large area solar cells via role-to-role methods, such as those used to print newspaper.

Recent Research Results:

1) We have examined the effect of processing on PEDOT:PSS films, a widely-used polymer electrode material and correlated variations in the density and current carrying capacity of these hot-spots with changes in the film's macroscopic properties. We have discussed how these changes can alter device performance. This was recently submitted to *J. Phys. Chem. C.*

2) We have observed previously unreported micron-scale ordering in polymer solar cells that may be optimized to improve their efficiency. From the series of images on the left, we deduce that areas of high power (bright-spots in (b)) correlate with locations where both good positive-carrier transport in observed (bright spots in (c)) and near hot-spots for negative-carrier transport (bright spots in (d)). While altering film processing conditions, we find that device performance increases while both the bright-domain size in (b) and the density of hot-spots in (d) increases. These results suggest that the development of a charge transport network in these materials could be crucial for the creation of efficient solar cells, and that ordering on the ~2-10 micron scale may be important.



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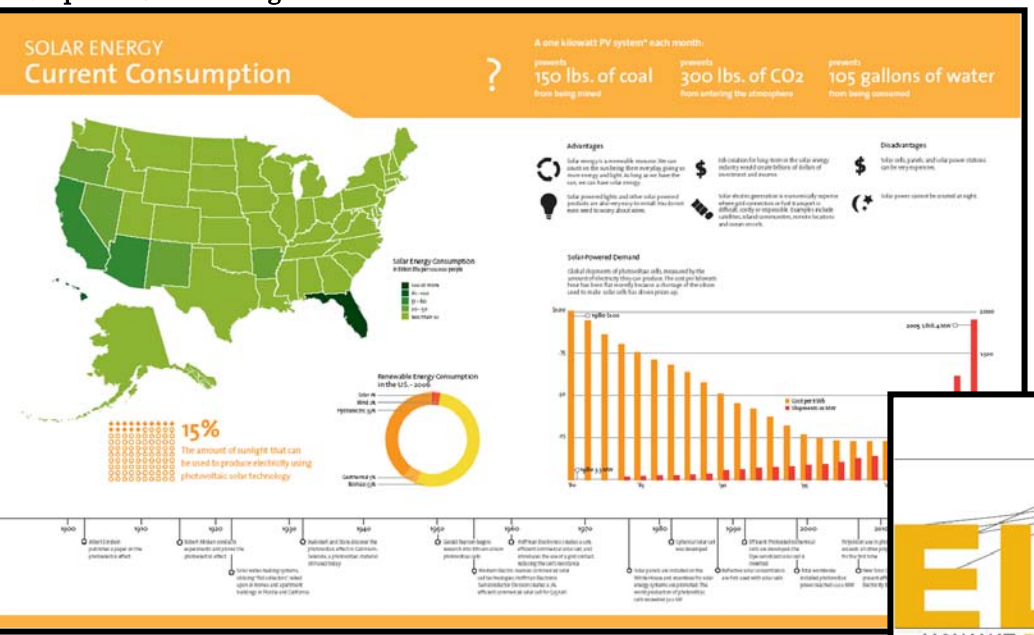
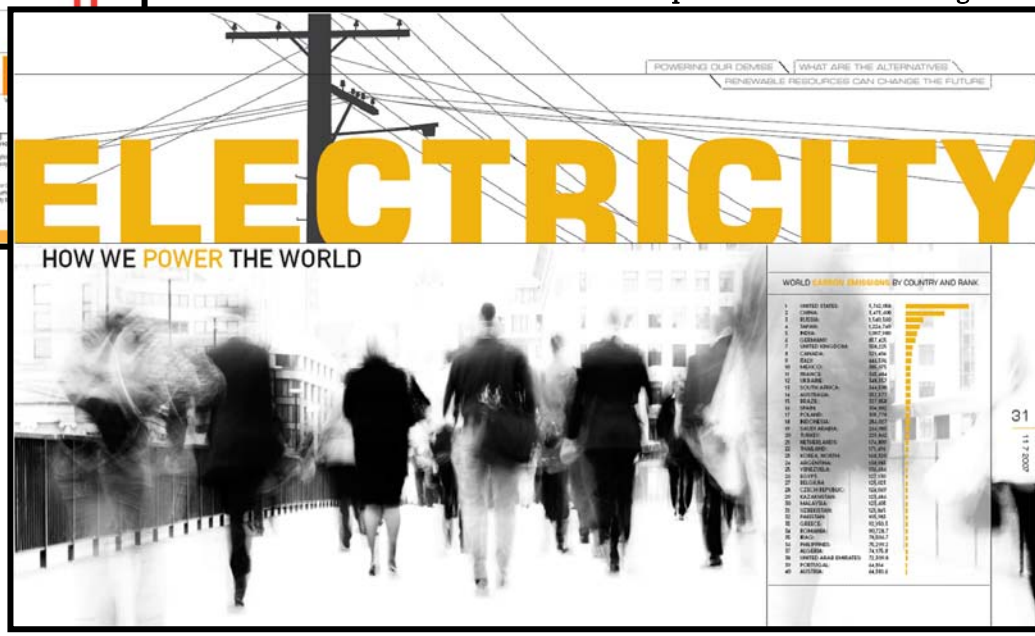
Graphics Credit: Megan Martin



Outreach Objective: Develop and initiate a public service science campaign for Seattle's bus system, utilizing the current hype surrounding alternative energy. This campaign will work to directed individuals to a website with information about alternative and solar energy information, as well as the wealth of ongoing outreach programs supported by the National Science Foundation.

Graphics Credit: Sean Douglass



Recent Outreach Results:

Over the past 4 months, ~35 art students worked collaboratively with the PI to learn about and develop informational graphic spreads on energy resources, including wind, hydroelectric, solar, ethanol, and nuclear power. In addition, similar panels were created on the environmental impact on coal, gasoline consumption, liquid natural gas, and others. Elements from these spreads will be used to develop a classroom poster on solar power, and serve as the base of the campaign. The introductory spread to a set of panels on electricity sources and one of three information spreads on solar energy are shown here. Work on the web portion has also begun, and a class of 30 students will be working on the site over the next three months. We have ~150 outreach sites in our list, and will be working on ways to easily navigate this for the website. We have also begun developing alternative campaign imagery and have begun assembling a group of chemistry students interested in working on their non-peer-to-peer science writing skills with Dr. Deborah Illman to create additional solar power content.