Major advance in organic solar cells

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Professor Guillermo Bazan and a team of postgraduate researchers at UC Santa Barbara's Center for Polymers and Organic Solids (CPOS) today announced a major advance in the synthesis of organic polymers for plastic solar cells.

Bazan's team:

- reduced reaction time by 99%, from 48 hours to 30 minutes, and
- increased average molecular weight of the polymers by a factor of more than 3.

The reduced reaction time effectively cuts production time for the organic polymers by nearly 50%, since reaction time and purification time are approximately equal in the production process, in both laboratory and commercial environments.

The higher molecular weight of the polymers, reflecting the creation of longer chains of the polymers, has a major benefit in increasing current density in plastic solar cells by as much as a factor of more than four. Over polymer batches with varying average molecular weights, produced using varying combinations of the elements of the new methodology, the increase in current density was found to be approximately proportional to the increase in average molecular weight.

The methodology, detailed in a *Nature Chemistry* paper published online

today and slated for later inclusion in the print publication, "will greatly accelerate research in this area," stated Bazan, "by making possible the rapid production of different batches of polymers for evaluation." He further noted, "We plan to take advantage of this approach both to generate new materials that will increase solar cell efficiencies and operational lifetimes, and to reevaluate previously-considered polymer structures that should exhibit much higher performance than they showed initially."

To make these gains, the team:

1. Replaced conventional thermal heating with microwave heating,
2. modified reactant concentrations, and
3. varied the ratio of reactants by only 5% from the nominal 1:1 stoichiometric ratio normally employed in polymerization reactions.

Mike McGehee, Director of Stanford's Center for Advanced Molecular Photovoltaics, hailed Bazan's work, commenting, "Many synthetic chemists around the world are making copolymers with alternating donor and acceptors to attain low bandgaps. Most of them are having trouble attaining adequate molecular weight, so this new synthetic method that creates longer polymer chains is a real breakthrough. The reduction in synthesis time should also make it easier to optimize the chemical structure as the research moves forward and will ultimately reduce the manufacturing cost."

More information: *Nature Chemistry* paper: dx.doi.org/10.1038/NCHEM.403

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