CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S1905

Project Title
"Green" Synthesis of Nanowires on FTO Substrates for Organic Dye-based Solar Cells: Analysis with New Rapid D-SCOPE 2.0

Abstract

Objectives/Goals
The objectives were: (1) to synthesize nanowires on FTO substrates using environmentally benign synthesis methods, (2) to integrate these into Dye-sensitized Solar Cells (DSCs), and (3) to construct a new low-cost tool to rapidly generate DSC characteristic curves.

Methods/Materials
ZnO nanowires were synthesized on conductive FTO substrates by a sonochemical route at room ambient. A low-cost organic dye was used to sensitize the nanowires by immersion at room temperature. DSCs were assembled using these photoanodes, electrolyte, catalyst, and spacer.
A new tool (D-SCOPE 2.0) was designed and programmed to generate DSC characteristic curves. From these curves, fill factor, maximum power output, and overall power-conversion efficiency was derived.

Results
ZnO nanowire DSCs achieved a higher fill factor than previously published results. Photocurrent density showed a linearly increasing trend with growth cycles. D-SCOPE 2.0 measurements occurred at rates typical of expensive laboratory equipment, at a much lower cost.

Conclusions/Discussion
Nanowire Solar Cells were successfully constructed using an end-to-end "green" synthesis method. Solar cells based on such inexpensive, environmentally benign DSCs could become a viable renewable energy source in a wide range of applications.
The new D-SCOPE 2.0 enables automated measurements at a rate on par with laboratory equipment, but at a cost that is affordable by budget-constrained students.

Summary Statement
A new low-cost nanowire solar cell was constructed using environmentally-friendly synthesis, and a new tool (D-SCOPE 2.0) was designed for rapid characterization.

Help Received
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