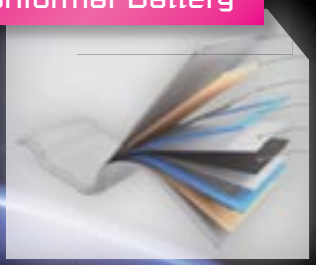
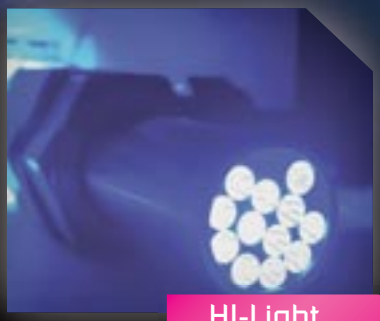
SPECIAL AWARDS SECTION

EJBot: Versatile Climbing Robot

Conformal Battery





HI-Light

Airfoil Performance Monitor

Create THE Future DESIGN CONTEST 2017

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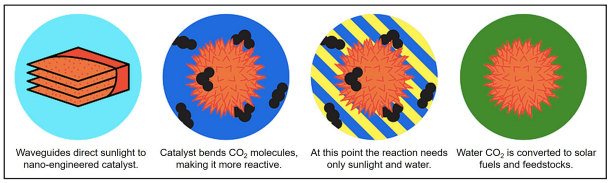
The Create the Future Design Contest was launched 16 years ago by Tech Briefs Media Group (publishers of *Tech Briefs* magazine) to help stimulate and reward engineering innovation. Since then, the annual contest has drawn more than 14,000 product design ideas from engineers, students, and entrepreneurs worldwide. Sponsored by COMSOL, Mouser Electronics, and Tech Briefs Media Group, the 2017 contest rewarded innovation in seven categories: Aerospace & Defense, Automotive/Transportation, Consumer Products, Electronics/Sensors/IoT, Machinery/Automation/Robotics, Medical, and Sustainable Technologies.

In this special section, you'll meet the Grand Prize Winner, as well as the winners and Honorable Mentions in all seven categories, chosen from more than 1,100 new product ideas submitted from 65 countries. To view all of the entries online, visit **www.createthefuturecontest.com**.

GRAND PRIZE WINNER

Winner of $20,000



HI-LIGHT — SOLAR THERMAL CHEMICAL REACTOR TECHNOLOGY FOR CONVERTING CO_2 TO HYDROCARBONS

Xiangkun (Elvis) Cao, Jessica Akemi Cimada da Silva, David Erickson, and Tobias Hanrath, Cornell University; and Jason Salfiand and Clayton Poppe, Dimensional Energy
Ithaca, NY

The extraction and consumption of fossil carbon to run our daily lives accounts for more than 6 billion metric tons of CO_2 emissions each year, driving climate change. Creating high-value products from CO_2 can be achieved using energy from all parts of the solar spectrum to photocatalytically produce liquid hydrocarbons at high temperatures, making CO_2 capture and conversion economical.

This technology enables the conversion of CO_2 back to simple hydrocarbons, e.g. into methanol, which has a typical spot price about six times higher, potentially transforming carbon conversion into a profitable enterprise.

The HI-Light reactor is a solar-thermocatalytic "reverse combustion" technology that enables the conversion of CO_2 and water to methanol and other high-value hydrocarbons. The HI-Light reactor design derives from the concurrent optimization of light-coupling and catalyst availability.

In the HI-Light design, the tubes are internal light-guiding rods with specially designed scattering surfaces that enable deep and efficient penetration of the solar radiation captured from a parabolic light concentrator into the reactor. The reagents and products flow through the shell outside the rods. The optimal energy focused into the reactor interacts with the catalyst to convert incoming sequestered CO_2. Photons with energies lower than those required for the catalytic reaction are used to provide thermal energy, and ultimately the high temperatures required to ensure selectivity and efficiency of the reaction to revert CO_2 to hydrocarbon fuels.

The major challenge of electrocatalysis is lowering the over-potential with breakthroughs in new catalysts. Up to now, product selectivity, lowering faradaic efficiency, and catalyst durability have been hard to achieve. The immense amount of power that it takes to drive the reaction leads to high operating costs. The unique design feature of the HI-Light reactor is the optimized light delivery to both a fixed and fluidized nanostructured catalyst, coupled with solar thermal heating to reach elevated temperatures, thereby enabling faster reaction rates and selectivity of higher hydrocarbons.

The aim of the business and technical efforts is to demonstrate that the reactor enables substantially improved performance in terms of efficiency, volumetric productivity, and mass of hydrocarbon per mass of catalyst per time, relative to the state-of-the-art.

Advances from the project will contribute significantly to the reduction of energy-related emissions, and will have a positive impact on energy storage. The Cornell team has been working with startup Dimensional Energy to commercialize this technology. In addition to advancing into Round 2 of the $20M NRG COSIA Carbon X-Prize, the team also has had significant interactions with Shell Oil through the Shell GameChanger program.

For more information, visit **http://contest.techbriefs.com/2017/grand_prize**

"I would like to express our greatest gratitude to the judges for choosing our team as the Grand Prize Winner of the 2017 Create the Future Design Contest. It is great recognition for our team. The Cornell team has been working with Dimensional Energy to convert the waste carbon dioxide into liquid fuels and feedstocks that power our economy and fit into a planetary carbon cycle through our unique HI-Light reactor. We will continue to advance our technology, and expect to contribute significantly to the reduction of energy-related emissions, with a positive impact on energy storage. This recognition is not for our team alone, but for the general science community to push forward renewable energy research."

- Elvis Cao