European Commission

ARTIFICIAL PHOTOSYNTHESIS: FUEL FROM THE SUN

EIC HORIZON prize

PRIZE FINALIST

5 December 2022

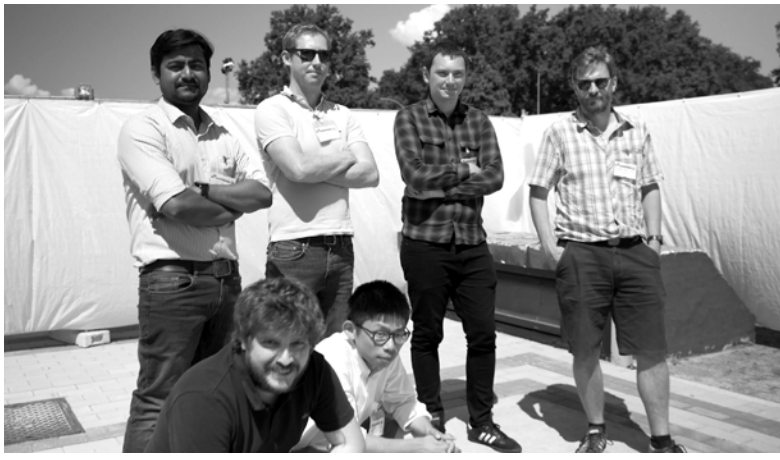
The Chancellor Masters and Scholars of the University of Cambridge

The EIC Horizon Prize **'Fuels from the Sun: Artificial Photosynthesis'** promotes new direct solar conversion technologies that deliver green fuels as a sustainable alternative to fossil energy as well as feedstocks for a range of industrial processes.

On 5 December 2022, during the Award Ceremony of the Prize, finalist **the University of Cambridge** was acknowledged for the achievements of their prototype **'Hybrid Perovskite Photoelectrochemical Leaf for Autonomous Syngas Production (CamSolarFuel)'**. Notably, their device has a highly integrated and simplified 'leaf' concept, reflecting in a pure sense the concept of artificial photosynthesis.

A fully functioning prototype to convert sunlight into green fuel

The solar fuels device that was developed uses sunlight to power the conversion of carbon dioxide and water into syngas fuel, a gas mixture consisting of hydrogen and carbon monoxide. The device enables direct solar-to-fuel conversion as it is based on an 'artificial leaf' design that mimics the natural leaf in form and function. Thus, the device delivers artificial photosynthesis and is distinct from other indirect solar-to-fuel approaches that require either a combination of photovoltaic and electrolysis or hydrogenation of carbon dioxide to produce carbon-based fuels.



Accelerating the Clean Energy Transition

The prototype demonstrates that artificial photosynthesis devices can be assembled using a simple design with low impact on resources and limited requirements of operation. It also shows a device configuration that can be readily transported and used in off-grid locations, thereby enabling its use where the current energy infrastructure is not deployable. The artificial leaves can be used in a decentralised and democratic energy-infrastructure that does not depend on fossil fuel resources and infrastructure.

How will this solution inspire other researchers and innovators?

The device can convert carbon dioxide and water directly into a renewable fuel using sunlight under benign conditions at room temperature and pressure. The relatively simple assembly allows for easy adaptation in other laboratories and development by other scientists. The device is exciting from a fundamental and applied science point of view and can therefore inspire academic scientists as well as researchers in industry.

BACKGROUND:

The **Horizon Prize 'Fuel from the Sun: Artificial Photosynthesis'** was launched in December 2017 as one of six European Innovation Council (EIC) Horizon Prizes and is also a European Union contribution to the activities under the Mission Innovation Challenge 'Converting Sunlight to fuels and chemicals'. The prize was open to the world, as it presents a good example of how the solutions of global challenges can be addressed by supporting the international research and innovation efforts in this area.

The prize rewarded the successful development of a fully functional, bench-scale prototype device of an artificial photosynthesis synthetic fuel production system, integrating the whole artificial photosynthesis process from light capture to fuel production that generates a fuel capable of powering a small engine.

Achieving the prize aim and objective takes current research out of the laboratory and into the realms of an engineering challenge, with a view to accelerating research and innovation in the field. Artificial photosynthesis is considered one of the most promising breakthrough technologies in the field due to its ability to use a combination of sunlight, water and carbon from the air to capture and store solar energy in an efficient and transportable form.

Publications Office
of the European Union

ISBN 978-92-76-59154-2, doi:10.2777/682437, KI-04-22-207-EN-N