Description of Funded Research Projects
1st Call for H.F.R.I. Research Projects to support Post-Doctoral Researchers

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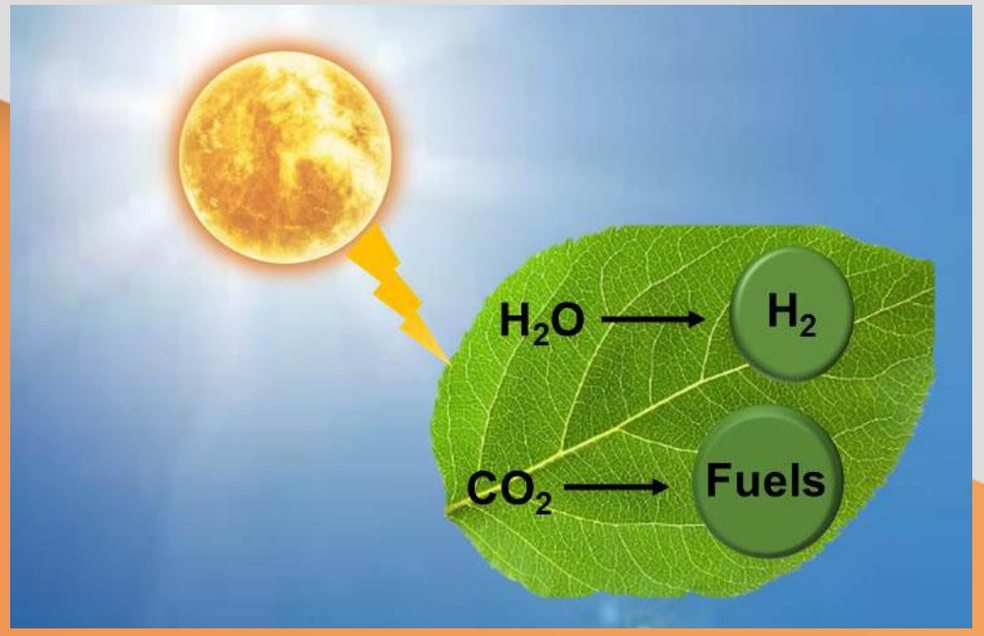
Research Project Title:

Development of Bio-Inspired Photocatalytic Systems for H2 Production and CO2 Reduction

Principal Investigator:

Georgios Charalambidis



Popular Title:

Συστήματα τεχνητής φωτοσύνθεσης για παραγωγή φιλικών προς το περιβάλλον καυσίμων

Scientific Field:

Natural Sciences

Host Institution:

University of Crete

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The decrease of total available reserves of fossil fuels along with the environmental problems caused by increased CO2 emissions, have turned research community interest towards developing catalytic systems which convert solar energy into exploitable fuels. Hydrogen is considered as the "ideal" fuel because its combustion with oxygen produces water and heat as the only byproducts. Therefore, the preparation of efficient catalytic systems that exploit solar energy for H2 production and CO2 reduction, can contribute to an ultimate green sustainable development of our planet, solving energy and environmental issues.

The target of the proposed project is the design and development of photo-catalytic systems for the utilization of solar energy in two separate ways: i) the production of hydrogen (H2) from water, and ii) the reduction of carbon dioxide (CO2) into useful fuel-products.

The proposed photocatalytic systems will be based in a recent and rather promising approach, which is the Dye-Sensitized Photo-Electrochemical Cells (DSPECs). In this configuration the chromophore and the catalyst are covalently linked and immobilized onto a semiconductor such as nickel oxide (NiO). The significant advantages of this approach are: i) the increased stability of the catalytic system and ii) the absence of the sacrificial electron donor, since by applying an external bias the NiO photo-cathode is able to provide electrons to the whole system. The proposed artificial photosynthetic devices will be based on elements that are abundant, low cost and environmentally friendly. Thus, they possess all the necessary features for their employment in large scale applications with potential commercial interest.

Project Impact on Society

Handling the constant depletion of fossil fuels, along with the world's increasing energy demands, is one of the most vital challenges in modern society. A great number of environmental issues are derived from fossil fuel consumption causing severe global warming. Therefore, the development of alternative energy sources is an essential challenge of the 21st century. Of all the available renewable energy sources, sunlight is by far the most advantageous candidate. The key goals of artificial photosynthesis are the photocatalytic reduction of aqueous protons to produce hydrogen (H2) and the conversion of carbon dioxide (CO2) to useful fuels.
The proposed systems do not contain noble metals; thereby manufacturing cost is low. This fact enables their application in large scale devices with potential commercial and industrial interest. The ultimate target is sustainable development whilst respecting the environment and the improvement of the research level by keeping young scientists in Greece.

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To me, H.F.R.I. funding would mean...

“H.F.R.I. funding for this program allows me to stay in Greece and also work under auspicious conditions with a competitive salary. Furthermore, it gives me the opportunity to form my own research group and work independently as the Principal Investigator (PI). Moreover, through the cooperation with other research centers as well as the participation in several scientific conferences, I expect to significantly enrich my knowledge in this field of research. The possibility of purchasing new equipment will really improve the working conditions, while simultaneously promoting the level of research and innovation of our country. This particular action finances basic research with the unique criteria of scientific quality and excellence, thus creating better prospects for my scientific and professional development.

The Principal Investigator,
Georgios Charalambidis

Funding

Amount: **200,000 €**

Duration: **36 months**

Foundation: **H.F.R.I.**

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