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

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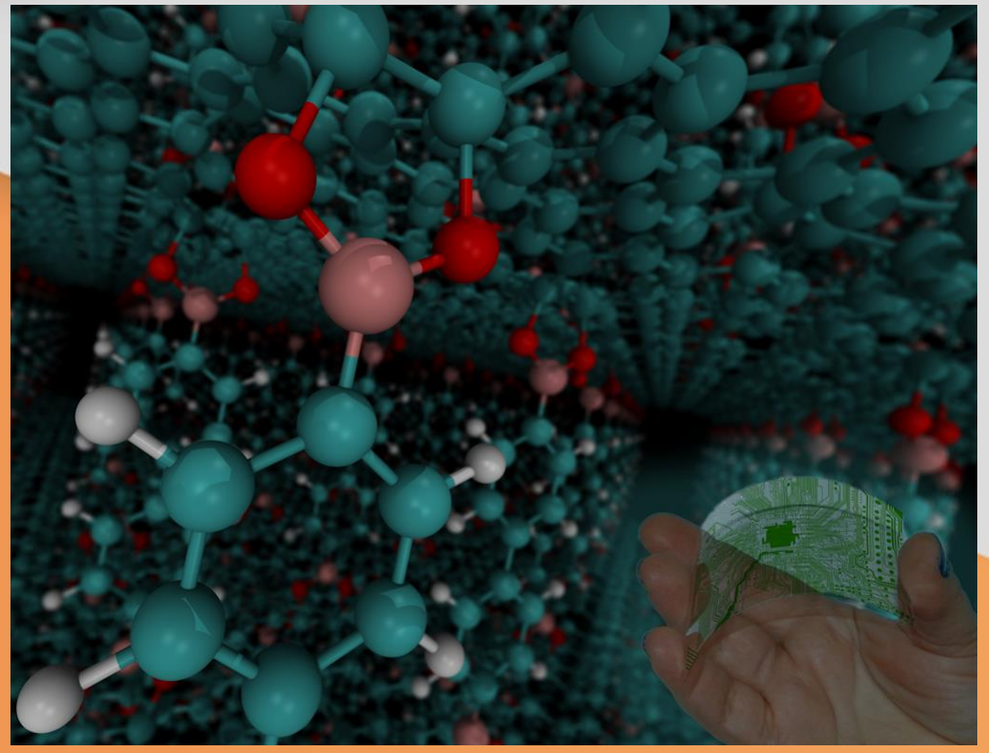
Research Project Title:

Designing pillared graphene nanomaterials with tuneable electronic properties and enhanced flexibility for electronic devices (GRAFEL)

Principal Investigator:

Emmanuel N. Koukaras



Popular Title:

Designing novel flexible nanomaterials targeted for applications in electronic devices (GRAFEL)

Scientific Field:

Natural Sciences

Host Institution:

Foundation for Research and Technology Hellas/ Institute of Chemical Engineering Sciences (FORTH/ICEHT)

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Research Project Summary

The vision for implementing this project has been primarily driven by the requirement of cheaper, large-area electronic devices that can be integrated on flexible substrates through low-temperature deposition or solution-based printing methods. The great challenge in the area is to surpass the respective disadvantages of inorganic and organic semiconducting materials for use in flexible electronics and design new materials that combine their advantages, namely controllable electronic properties accompanied by mechanical conformability. From a device design perspective, such materials will also lead to minimization of contact issues (heat dissipation, contact resistance) associated with the interface which exists when multiple materials are combined.

Dr. Emmanuel N. Koukaras, from the Institute of Chemical Engineering Sciences in Patras, will address this challenge through this highly ambitious research project that offers no less than to open a new field of research on graphene-based flexible electronics and promote it to a level of maturity that accompanies establishing procedures for (a) the adjustment of material properties by design, (b) the chemical synthesis of components, and (c) rudimental device fabrication as proof of concept.

The implementation of the project demands combination of multiple disciplines and skills, and with close interaction, for a successful outcome on all levels, from the design stage, to the estimation of properties, to the synthesis of the materials and upscale of the processes, and finally the fabrication of a rudimentary electromechanical device. Only through such a collaboration in efforts can there be a successful outcome.

Apart from the promotion of excellence of Greek science worldwide, these materials can become the starting point for establishing a start-up company providing the materials, and important international collaborations towards their commercialization for a large variety of applications. The belief is that the implementation of the current research project will make the resulting nanomaterials the new rising star for several emerging applications especially in nano-electronics, energy storage and conversion, chemical sensors, nanofiltration and photocatalysis.

Project Impact on Society

The targeted nanomaterials offer great prospects for technological applications, with flexible electronics being the most apparent. The project offers the basis by which these materials can be systematically synthesized, thus reducing any timeframe to a presumable commercialization. Successful completion of the project will pave the road to applications, and in such a case a high-tech spin off company may be created for device fabrication and commercialization. This marks the creation of jobs. The added value is brain gain though the employment of young scientists, while increasing the national reputation and scientific/technological achievements worldwide.

Emerging applications of these nanomaterials are expected in areas with a high social impact, some more long term than others, and especially in nano-electronics, energy storage and conversion, chemical sensors, nanofiltration and photocatalysis.

Given the grim economic situation of the country in recent years, it seems very suitable to accentuate a direct socio-economic aspect; the GRAFEL program has committed a very high 72% of the total budget (79% not including overhead) to wages for three postdoctoral researchers and postgraduate students. This ensures that the highly skilled personnel remain in the country while involved in world class research, thus contributing to the reduction of brain-drain.

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

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The H.F.R.I. funding program has offered me multiple benefits. Through the funding I have obtained the required independence to pursue my research interests, further my research objectives, and minimize sidetracks. In part, this is accomplished by establishing my own research group, with members that are highly capable in their respective fields. The funding comes at a time where the country’s grim economic reality has led abroad many researchers, and has provided me with the means to remain and perform internationally competitive research within my country. As a Principle Investigator I am now able to establish new collaborations, of my choosing, and to inquire new paths to fulfill my research goals. Equally important is the recognition I have received from my peers, that I am sure will greatly enhance my prospects for an academic career.

The Principal Investigator,

Emmanuel N. Koukaras

Funding

Amount: **449,990 €**

Duration: **36 months**

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

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