

***Dye Sensitized Solar Cells With Integrated 3D Graphene Structures***  
***Acronym DSSC-WIDGET***

**Project Registration Code: PN-III-P2-2.1-PED-2016-1159**

**Contract number: 129PED/2017**

**Financing:** Public budget

**Programme:** Programme 2 - Increase Competitiveness of the Romanian Economy through Research, Development and Innovation, Subprogramme 2.1. Competitiveness through Research, Development and Innovation

**Research domain:** 4 - Eco-Nano-Technology and Advanced Materials

**Project type:** Experimental demonstrative project (PED)

**Total amount of the contract:** 600.000 lei

**Of which, by financing sources:**

**Source 1 – public budget:** 600.000 lei

**Source 2 – own budget:** 0 lei

**Contract duration:** 18 months (03.01.2017 - 30.06.2018)

**Contracting Authority:** Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)

**Contractor:** NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN ELECTRICAL ENGINEERING ICPE-CA BUCHAREST (INC DIE ICPE-CA)

**Partner P1:** NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN MICROTECHNOLOGIES IMT BUCHAREST (IMT)

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### **Abstract:**

The large concern of global energy challenges has greatly increased the interest and investments in renewable and clean energy that can replace fossil fuel. Among all known systems to generate energy, solar power is the most promising one. Hence, no one doubts the important role that photovoltaics (PV) are going to play in the energy of the future. The main drawbacks of the current PV technologies are their high production cost and rigid structure in the case of traditional silicon and inorganic semiconductors, or their reduced efficiency and durability in the case of organic and DSSC photovoltaics. One of the bottlenecks of increasing the conversion efficiency in DSSC is the transport of photogenerated electrons. The general approach to surpass these limitations is employing one of the following strategies: doping, growing vertically oriented porous structures on top of the conducting substrate, interconnecting TiO<sub>2</sub> nanoparticles with charge carriers to direct the photogenerated current or find alternative materials with higher electronic mobility. Due to the richness of its optical and electronic properties, 3D graphene is the material of choice for our proposed studies. The ability to develop free-standing 3D graphene structures with large specific surface area will enable the successful realization of fast transport channels of charge carriers, thus leading to high electrical conductivity. Moreover, by combining their good electrical conductivity with their porous structure, the 3D graphene structures will increase the photocurrent density of DSSC by enhancing light absorption (sensitizer loading), enabling efficient charge separation and light scattering. In this context, the general objective of the project is: to evaluate the functionality of the 3D graphene structures in optoelectronic devices, specifically in photovoltaic cells (DSSC).

### **Research teams:**

#### **Coordinator CO - INCDIE ICPE-CA Bucharest**

1. **PhD Banciu Cristina – IDT II, Project manager**
2. PhD Băra Adela – IDT I, Key person
3. Iordache Iulian – IDT I, Key person
4. Teișanu Aristofan – CS III, Key person
5. PhD Chițanu Elena – CS, Key person
6. PhD Ion Ioana – CS III, Research team member
7. PhD Pătroi Delia – CS II, Research team member
8. PhD Sbârcea Gabriela – CS III, Research team member
9. PhD Tsakiris Violeta – CS I, Research team member
10. PhD Lungulescu Marius – CS III, Research team member
11. PhD Morari Cristian – CS III, Research team member
12. Vlad Dorina – Technician, Research team member
13. Barbu Marin – Technician, Research team member
14. Vicol Ana – Worker, Research team member

#### **Partner P1 - IMT Bucharest**

1. **PhD Lucia Monica Veca - CS I, Project responsible**
2. PhD Emil Mihai Pavelescu - CS I, Key person
3. PhD Florin Năstase - CS II, Key person

4. PhD Radu Cristian Popa - IDT I, Key person
5. PhD Titus Sandu - CS I, Research team member
6. Cristina Ionela Pachiu - CS III, Research team member
7. Ligor Octavian - CS III, Research team member
8. Raluca Gavrilă - CS III, Research team member
9. Marian Popescu - CS III, Research team member
10. Anca Ionela Istrate - CS III, postdoctorand, Research team member
11. Iuliana Mihalache - CS III, postdoctorand, Research team member
12. Cosmin Obreja – PhD student, Research team member
13. Cosmin Romanițan - PhD student, Research team member
14. Carmen Margareta Iorga - engineer, Research team member
15. Adrian Albu - engineer, Research team member
16. Paznicu Marioara - Research team member
17. Nistor Elena - Research team member

**Project objectives:**

The general objective of the project **PN-III-P2-2.1-PED-2016-1159** entitled: “*Dye Sensitized Solar Cells With Integrated 3D Graphene Structures*” (Acronym: **DSSC-WIDGET**) is to evaluate the functionality of the 3D graphene structures in optoelectronic devices, specifically in photovoltaic cells (DSSC), by: (1) to explore several strategies towards controlled synthesis of 3D graphene structures that will enable device operation and (2) to develop a specialized technology of DSSC devices obtaining based on graphene.

In order to achieve the overall objective of the project, it is necessary to achieve the following specific objectives:

- Documentary study on the identification of experimental configurations for the growth and transfer of the 3D graphene;
- Synthesis of 3D graphene structure on the metal catalyst;
- Structural and morphological characterization of the 3D graphene structure on the metal catalyst;
- Removing the metal catalyst from the 3D graphene structure;
- Functionalization of the 3D graphene structure;
- Structural and morphological characterization of the functionalized 3D graphene structure;
- Optical and electrical characterization of the functionalized 3D graphene structure;
- DSSC achievement by integrating the 3D graphene structure;
- Demonstration of DSSC functionality;
- Project results dissemination on a large scale, during and after its completion, through the elaboration, communication and publication of scientific articles, increasing the visibility of applied research at national and international level by promoting new products at different technical and scientific events.

**Project stages:**

**Stage I**

**Stage name:** *Obtaining and transfer of 3D graphene structures for DSSC applications*

**Activity type:** Industrial research

**Partners involved:** CO, P1

**Stage duration:** 03.01.2017 – 31.12.2017

**Stage II**

**Stage name:** *DSSC achievement. Demonstration of DSSC functionality*

**Activity type:** Industrial research / Experimental development

**Partners involved:** CO, P1

**Stage duration:** 01.01.2018 – 30.06.2018

**Expected results:**

- Documentary study;
- Experimental Models (EM) of 3D graphene structures;
- Functional model (FM) of DSSC photovoltaic cell with integrated 3D graphene structures;
- Patent applications registered at OSIM;
- Scientific papers communicated at national and international technical and scientific events;
- Scientific papers submitted for publication in ISI rated journals;
- Project website.

**Contact:**

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**Partner P1: IMT Bucharest**

Project responsible P1: PhD Lucia Monica VECA

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