

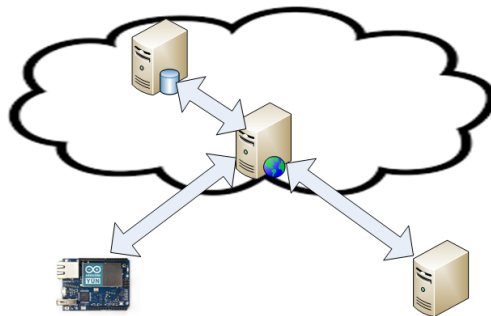


## LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – *DINper* research group.

The University of Burgos is delighted to welcome students from The Cooper Union. The positions are offered by several research groups working on different engineering fields as described in the following sections:

### Internet of Things.

One of the key evolutions of technological devices in the last few years has been oriented towards connectivity. Connected with the previous offer, connected technological devices can make life easier to people affected by many types of disabilities. Our research group is on the search for certain applications making use of the latest developments of technology and even for innovative ways to connect devices to the internet.



The whole process involves:

- Hardware designing.
- Wireless devices programming
- Database configuration
- Remote access
- Remote control

WHAT WE OFFER TO COOPER UNION STUDENTS:

- Design and manufacturing of wireless devices.
- C++, php...
- Web site design.



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STUDENTS PROFILES:

- Electrical Engineering students (1 position).
- Computer Engineering (1 position).

COORDINATOR/CONTACT PERSON: Dr. José M. Cámara ([checam@ubu.es](mailto:checam@ubu.es)).

## **LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – DIN<sub>per</sub> research group & Electrochemical Processes and Energy Storage group.**

### **Batteries.**

Energy Storage Systems (ESSs) have become essential elements in our modern society. Among the various EESs, batteries have experienced a rapid growth driven by the expanding market of portable electronics, implementation of energy from renewable sources, electrification of transportation, and other emerging technologies. In collaboration with Dr. Ventosa's group from Chemistry Department, our research group develops strategies for automatization of processes during battery operation, which also include connectivity solutions.

In the three topics, the whole process involves:

- Hardware designing.
- Wireless devices programming
- Database configuration
- Remote access
- Remote control

WHAT WE OFFER TO COOPER UNION STUDENTS:

- Design and manufacturing of wireless devices.
- C++, php...
- Web site desig.

STUDENTS PROFILES:

- Electrical Engineering students (1 position).
- Computer Engineering (1 position).

COORDINATOR/CONTACT PERSON: Dr. José M. Cámara ([checam@ubu.es](mailto:checam@ubu.es)) /Dr. Edgar Ventosa ([eventosa@ubu.es](mailto:eventosa@ubu.es)).



## **LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – *DINper* research group & Environmental and industrial biotechnology group.**

### **Water treatment plants.**

Water purification along with biogas production is one critical step towards a sustainable and environmentally friendly society. In this project we try aim to develop viable biological reactors to achieve these goals. The position we offer is meant to attract students interested in helping us to automatize, monitor and provide remote command for the reactors. IoT technologies are expected to be applied.

The work involves:

- Wireless devices programming
- Database configuration
- Remote access
- Remote control
- Artificial Intelligence for modeling and prediction

WHAT WE OFFER TO COOPER UNION STUDENTS:

- Device programming
- PLC connection and configuration
- Sensoring
- Python, C++, Visual Basic, php...
- Neural network design

STUDENTS PROFILES:

- Electrical Engineering students (1 position).
- Computer Engineering (1 position).

COORDINATOR/CONTACT PERSON: Dr. José M. Cámara ([checam@ubu.es](mailto:checam@ubu.es)) /Dr. Victorino Díez ([vdiezb@ubu.es](mailto:vdiezb@ubu.es)).

## **LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY - Research Group on Energy Engineering**



**Research Line:**

Research on thermodynamic properties of new refrigerant and heat transfer fluids, formulated to mitigate the Climate Change.

**Coordinator / contact person:**

Dr. Natalia Muñoz Rujas (nmrujas@ubu.es).

**Description:**

The knowledge on thermodynamic properties of pure fluids and their mixtures is of common interest in any industrial area. In applications such as refrigeration, it is necessary to well know the boiling temperature of the fluid, as well as its change on density with pressure and temperature. In fields as high precision cleaning, the knowledge of viscosity or surface tension are of utmost importance. In the same way, the characterization of an azeotrope, its composition at a fixed pressure and temperature, has utility in most of industrial applications in which the fluid changes from liquid to vapor state. In the field of industrial fluids, the environmental issue has grown as a new requirement that has to be fulfilled for commonly used fluorocarbons: CFCs (chlorofluorocarbons), HCFCs (hydrochlorofluorocarbons), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and PFPEs (perfluoropolyethers), among others. Some of these fluorocarbons had great ozone depletion potentials (ODP), while others shown high global warming potentials (GWP). Also, their long atmospheric lifetimes (ALT) made them extend their harmful effect over the years on the environment.

Hydrofluoroether fluids (HFEs), are a class of new industrial fluids with low environmental effect. HFEs have been considered as good alternative in the replacement of CFCs, HCFCs, PFCs, PFPEs, and even HFCs, due to they exhibit values of thermophysical and chemical properties similar as the previously used fluorocarbons, including high volatility, low thermal conductivity, low surface tension, zero or near zero Ozone Depletion Potential (ODP), low Global Warming Potential (GWP), low toxicity, being most of them non-flammable.

This project deals with the accurate measurement, correlation and prediction of thermodynamic and transport properties properties of new refrigerants and their mixtures (density, viscosity, thermal conductivity, isobaric heat capacity, vapor-liquid equilibrium behaviour, water immiscibility range, distillation curve, mixing enthalpy and heating values) at different pressure and temperature conditions.

**Priority Area:**



Renewable energy, sustainability.

**Student profile:**

Mechanical Engineering, Chemical Engineering, B.Sc. Physics, B.Sc. Chemistry.



**Recent references:**

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I. Abala, F.E.M. Alaoui, Y. Younes, A. S. Eddine, N. Muñoz-Rujas, F. Aguilar. Density of biofuel mixtures (Dibutyl ether + heptane) at temperatures from (28.15 393.15) K and at pressures up to 140 MPa: Experimental data and PC-SAFT modeling, *Fluid Phase Equilibria*, 2019, 491, 35-44.

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## LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – Structural Integrity research group.

**Position 1: Fatigue and fracture of materials, components and structures.**

STUDENTS PROFILES: Mechanical Engineering / Civil Engineering (2 positions).



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COORDINATOR/CONTACT PERSON: Professor D. Jesús Manuel Alegre ([jalegre@ubu.es](mailto:jalegre@ubu.es)).

Brief description:

The Structural Integrity research group of the University of Burgos is in one of the most relevant research group in Europe, related to the testing and numerical simulation of fatigue and fracture of metallic materials. In this research you will learn about fracture and fatigue testing methods, numerical simulation of fatigue and fracture of metallic materials and its application to the design of components and structures. Also you have the opportunity to initiate in some experimental techniques to measure residual stresses in components, such as the *hole drilling* method, and to know the effect of residual stresses in the fatigue behavior of metallic materials.



## LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – Sustainable Construction Research

The positions are offered by several working groups specialized on different engineering fields as described in the following sections related with the project FULLSCALE.

### Project title: A full-scale study of sustainable high performance hydraulic and bituminous concretes, manufactured with steelmaking and construction waste (FULLSCALE)

Introductory video: <https://youtu.be/xPaoZ--YF-I>

The FULLSCALE proposal aims to turn massive waste, electric steelmaking slags (EAFS/LFS), and Recycled Concrete Aggregates (RCA), into noble raw materials to manufacture high value-added products for the construction sector, and to redirect patterns of growth towards the circular economy, contributing to the conservation of natural heritage and to curbing climate change.

Previous research has shown that the use of EAFS/LFS/RCA in technical mixtures is feasible, but there is still a significant time-span until the desired standardization is reached with industrial applicability. FULLSCALE therefore seeks to advance through the necessary scaling-up for its future industrialization and, in that way, to address the execution of full-scale pilot demonstrations, in the form of both hydraulic-cement beams and bituminous pavements.

The methodology involves both the design and the characterization of these (self-compacting /permeable) high-performance mixtures, followed by the construction of the demonstration beams/pavements and finally, the study of their structural behavior, durability, and safety. Furthermore, elements of additional added-value are introduced in the study, such as the replacement of clinker by LFS, the use of low-energy techniques, and the incorporation of fibers.

**Keywords:** Slags, Recycled Concrete Aggregates, sustainability, circular economy, construction, concrete, beam, pavement, bituminous mixture, CO<sub>2</sub>

### Internship 1: Reuse of Recycled Concrete Aggregate (RCA) in building applications.

PhD. Juan M. Manso ([jmmanso@ubu.es](mailto:jmmanso@ubu.es)) and

PhD. Vanesa Ortega-López ([vortega@ubu.es](mailto:vortega@ubu.es))

**Contents:** Study of self-compacting concrete manufactured with coarse and fine Recycled Concrete Aggregate (RCA) and its use in real beams. The beams will be tests in shear and bending





tests. In order to maximize the sustainability in the construction sector, Supplementary Cementitious Materials (SCM) will be also incorporated in the concrete mix.

### Internship 2: Reuse of steelmaking slags in concrete pavement

PhD. Juan M. Manso ([jmmanso@ubu.es](mailto:jmmanso@ubu.es)) and

PhD. Vanesa Ortega-López ([vortega@ubu.es](mailto:vortega@ubu.es))

**Contents:** Development of concrete formulations made with steelmaking slags (Electric Arc Furnace Slag-EAFS-and Ladle Furnace Slag-LFS) applied to pavements: industrial slags and wearing courses of roads. Laboratory formulations for basic characterization will be addressed according to applicable regulations and trying to meet the requirements of the industrial pavements and road wearing courses.

### Internship 3: Reuse of steelmaking slags in bituminous mixtures

PhD. Juan M. Manso ([jmmanso@ubu.es](mailto:jmmanso@ubu.es)) and

PhD. Marta Skaf ([mksaf@ubu.es](mailto:mksaf@ubu.es))

**Contents:** Manufacture of bituminous mixtures with EAFS as coarse aggregate and LFS as filler, analyzing their behavior as draining base and wearing course for roads. Abrasion and tire adhesion will be tested, as much as its mechanical behavior with heavy traffic in its key issues: flexibility, dissipation ability and fatigue resistance. Long-term study of a road wearing course already construct with a patented material by the group.

### WHAT WE OFFER:

Collaborative working in laboratory testing of large structures and construction materials.

### STUDENTS PROFILES:

One or Two Students of Civil Engineering

### REFERENCES

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<https://hormec.es/>

<https://www.ubu.es/unidad-de-investigacion-consolidada-uic-231-tecnologia-de-estructuras>





**Figure 1 and 2. Beams manufactured with RCA**



**Figure 3 and 4. Concrete pavements manufactured with steelmaking slags**



**Figure 5 and 6. Bituminous mixtures manufactured with steelmaking slags**