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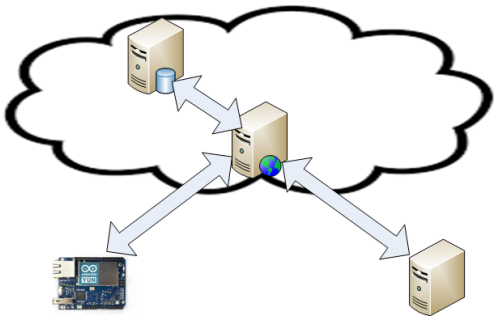
LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – DIN*per* research group.

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 desig.

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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).

LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – DIN*per* 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 expending 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) /Dr. Edgar Ventosa (eventosa@ubu.es).

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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. Website: https://www.ubu.es/energy-engineering-research-group-ienergia

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 precission 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 industry 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 inmiscibility range, distillation curve, mixing enthalpy and heating values) at different pressure and temperature conditions.

Priority Area:

Renewable energy, sustainability, energy efficiency, Climate Change.

Student profile:

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

Recent references:

M. Lifi, G. Rubio-Pérez, H. Lifi, N. Muñoz-Rujas, F. Aguilar, F. E. M'hamdi Alaoui. Excess properties of mixtures containing 2-(2-ethoxyethoxy)ethanol, methylcyclohexane, cyclohexane and 1-hexene as fuel representative, Journal of Chemical Thermodynamics, 2023, 177, 106933.

N. Lamia Benkelfat-Seladji, F. Ouaar, A. Hernández, I. Bahadur, N. Muñoz-Rujas, S. Kumar Singh, E. Montero, N. Chiali-Baba Ahmed, L. Negadi. Density, speed of sound, refractive index of binary mixtures

containing 2-ethoxyethanol and some alcohols: Measurement and correlation, Journal of Chemical Thermodynamics, 2021, 170 – 106762, 1-18.

I. Abala, M. Lifi, F. E. M'hamdi Alaoui, N. Muñoz-Rujas, F. Aguilar, E. A. Montero. Thermophysical Property Measurements and Modeling of (Ether + Alkanol + Hydrocarbon) Mixtures: Binary and Ternary Mixtures (Dibutyl Ether + 1-Butanol + 1-Hexene or + Iso-octane) at 298.15 K, Journal of Chemical and Engineering Data, 2021, 66, 3417 – 3431.

M. Lifi, J-P. Bazile, N. Muñoz-Rujas, G. Galliero; F. Aguilar, J-L. Daridon. Density, Viscosity, and Derivative Properties of Diethylene Glycol Monoethyl Ether Under High Pressure and Temperature, Journal of Chemical & Engineering Data, 2021, 66, 3 1457-1465.

I.Abala, M. Lifi, F. E. M'hamdi Alaoui, N. Muñoz-Rujas, F. Aguilar, E. A. Montero. Density, Speed of Sound, Isentropic Compressibility, and Refractive Index of Ternary Mixtures of Oxygenated Additives and Hydrocarbons (Dibutyl Ether + 1-Butanol + Toluene or Cyclohexane) in Fuels and Biofuels: Experimental Data and PC-SAFT Equation-of-State Modeling, Journal of Chemical & Engineering Data, 2021, 66, 1406 – 1424.

G. Rubio-Pérez, N. Muñoz-Rujas, F. Aguilar R. Ravotti, L. Müller, E. Montero. Evolution of the Study of Phase Diagram of Binary and Ternary Mixtures Involving Fatty Acid Esters, Materials, 2021, 14 – 369.

D. Belhadj, I. Bahadur, A. Negadi, N. Muñoz-Rujas, E. Montero, L. Negadi. Thermodynamic, Ultrasonic, and Transport Study of Binary Mixtures Containing 2-(2-Methoxyethoxy)ethanol and Alcohols at (293.15–323.15) K, Journal of Chemical & Engineering Data, 2021, 65, 5192 – 5209.

L. Müller, G. Rubio-Pérez, A. Bach, N. Muñoz-Rujas, F. Aguilar, J. Worlitschek. Consistent DSC and TGA Methodology as Basis for the Measurement and Comparison of ThermoPhysical Properties of Phase Change Materials, Materials, 2020, 13 – 4486.

M. Lifi, J. Lorenzo, F. Aguilar, N. Muñoz-Rujas, E. A. Montero, Y. Chhiti, F. E. M. Alaoui. Excess enthalpy, density, speed of sound and refractive index of binary mixtures {2-(2-ethoxyethoxy)ethanol + 1-hexene, or cyclohexane, or methylcyclohexane at (298.15 and 313.15) K: Application of the PPR-78 cubic equation of state, NRTL and UNIQUAC models, Journal of Chemical Thermodynamics, 2020, 153.

M. Lifi, G. Rubio-Pérez, F. E. M. Alaoui, N. Muñoz-Rujas, F. Aguilar, E. A. Montero. High-Pressure Volumetric Properties of the Binary Mixtures (Di-isopropyl Ether + n-Heptane or Methylcyclohexane), Journal of Chemical and Engineering Data, 2020, 65, 4892-4904.

N. Muñoz-Rujas, G. Rubio-Pérez, E. A. Montero, F. Aguilar. Isobaric Vapor−Liquid Equilibria at 50.0, 101.3, and 200.0 kPa. Density and Speed of Sound at 101.3 kPa and 298.15 K of Binary Mixtures HFE-7100 + 2-Propanol, Journal of Chemical & Engineering Data, 2020, 65, 4290-4298.

N. Muñoz-Rujas, J. P. Bazile, F. Aguilar, G. Galliero, E. A. Montero, J. L. Daridon, C. Boned. High-Pressure Viscosity Measurements for the Binary Mixture HFE7500 + Diisopropyl Ether, Journal of Chemical and Engineering Data, 2019, 64, 5332-5337.

I. Abala, F. E. M. Alaoui, A. S. Eddine, F. Fernando, N. Muñoz-Rujas, E. A. Montero. (ρ, VE, T) Measurements of the Ternary Mixture (Dibutyl Ether + 1-Heptanol + Heptane) at Temperatures up to 393.15 K and Pressures up to 140 MPa and Modeling Using the Peng−Robinson and PC-SAFT Equations of State, Journal of Chemical and Engineering Data, 2019, 64, 3861-3873.

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.

H. Makhlouf, N. Muñoz-Rujas, F. Aguilar, B. Belhachemi, E. A. Montero, I. Bahadur, L. Negadi, Density, speed of sound and refractive index of mixtures containing 2-phenoxyethanol with propanol or butanol at various temperatures, Journal of Chemical Thermodynamics, 2019, 128, 394-405.

N. Muñoz-Rujas, J. P. Bazile, F. Aguilar, G. Galliero, E. Montero, J. L. Daridon, Speed of sound, density and derivative properties of binary mixtures HFE-7500 + Diisopropyl ether under high pressure, Journal of Chemical Thermodynamics, 2019, 128, 19-33.

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G. Rubio-Pérez, N. Muñoz-Rujas, A. Srhiyer, E. A. Montero, F. Aguilar, Isobaric vapor-liquid equilibrium, density and speed of sound of binary mixtures 2,2,4-trimethylpentane þ 1-butanol or dibutyl ether (DBE) at 101.3 kPa, Fluid Phase Equilibria, 2018, 475, 10-17

N. Muñoz-Rujas, F. Aguilar, J.M. García-Alonso, E. A. Montero, "High pressure density and speed of sound of hydrofluoroether fluid 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-(trifluoromethyl)-pentane (HFE-7300)", Journal of Chemical Thermodynamics, 2018, 121, 1-7.

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).

COORDINATOR/CONTACT PERSON: Professor D. Jesús Manuel Alegre (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.

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

WEBSITES OF THE GROUP:
https://www.ubu.es/construccion-sostenible-sucons
https://investigacion.ubu.es/grupos/1820/detalle
https://www.ubu.es/unidad-de-investigacion-consolidada-uic-231-tecnologia-de-estructuras

The positions are offered by several working groups specialized on different engineering fields as described in the following sections:

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POSITION 1: Reuse of by-products from steelmaking industry in building and civil applications

STUDENT PROFILE: Civil Engineering.

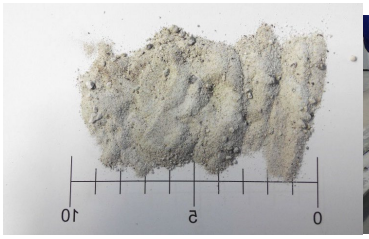
COORDINATORS: Dr. Juan Manuel Manso (jmmanso@ubu.es), Dr. Vanesa Ortega-López (vortega@ubu.es) and Marta Skaf (mskaf@ubu.es)

PROJECT DESCRIPTION:

From the science of material (knowledge) to the concept of final product (construction market), this project would climb the study of the incorporation of some industrial by-products of manufacturing steel in certain materials and building products. As a key sector of our country, the manufacture of electric steel industry, massively, generates two types of by- products: EAFS - black oxidizing slag and LFS - white reducing slag from steelworks. On the other hand, the construction industry is a major consumer of raw materials. Therefore, strengthening in the knowledge applied already existing on the subject, in addition to opening new fields of use, this project raises the reuse of the EAFS and LFS in applications for building and civil engineering, as a component of value added in inorganic matrices (cement pastes, mortar and concrete), organic (mixtures with asphaltic bitumen) and mixed (improvement of soils). All this by maximizing the sustainable value of the solutions adopted according to a triple perspective: functional, energetic and economic (market viability); for which in order to analyse the sustainable value of the solutions adopted, against other more conventional. Ultimately, with this project, it is tried to steer this new ways, which have been called the blue economy, towards the construction sector. The relevance of this coordinated project is referred to the construction market in aspects such: "formula of work" (mortar/concrete/asphalt plants), "additions" (cement) and "types of soil" (paver).

Videos:

https://youtu.be/xPaoZ--YF-I

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POSITION 2: Concrete manufacturing incorporating wind turbine blade waste and recycled concrete aggregate

STUDENT PROFILE: Civil Engineering.

COORDINATORS: Dr. Juan Manuel Manso (jmmanso@ubu.es) and Dr. Vanesa Ortega-López (vortega@ubu.es)

PROJECT DESCRIPTION:

In the wind-energy sector, an important technological change is taking place that means that wind turbines with a working life of over 25 years have to be replaced by others of greater power. It is estimated that 50% of all installed wind-power capacity (30 GW) before 2030, will be renewed in Spain (5th highest wind power capacity in the world). This fact acquires special importance in Castile and Leon, because it is the region with the most wind farms (6.4 GW) in Spain.

The removal of obsolete wind turbines generates enormous amounts of waste, among which its turbine blades and concrete foundations, for which solutions have to be sought for their reuse, with a view to protecting the natural, economic, and industrial environment.

This project seeks to use both crushed wind-turbine blades and Recycled Concrete Aggregate (RCA) as waste products for the precast concrete industry. To do so, their mechanical processing will in the first place have to be defined, so that suitable raw materials for concrete manufacture may be obtained; secondly, work will take place on the design of high workability concretes, and the evaluation of their mechanical behavior and durability; thirdly, the environmental impact and the economic cost of manufacturing mixtures will be studied; and, finally, the waste content of the concretes will be optimized for different precast products on the basis of economic and environmental performance criteria, which will provide both innovative and competitive industrial solutions.

Videos:

https://youtu.be/qXI91rURTek