

**Research Studentship (for student of a course that does not award an academic degree)**

Applications are open for one Research Studentship, within the framework of project/R&D institution (SoCaLTES- Solar-driven Ca-Looping Process for Thermochemical Energy Storage/Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento), reference PTDC/EAM-PEC/32342/2017, financed by national funds through FCT/MCTES (PIDDAC), under the following conditions:

**Scientific Area:** Chemical Engineering Sciences

**Admission Requirements:**

*a) to hold a master degree and be enrolled at a course that does not award an academic degree and it is integrated in the educational project of a higher education institution, performed in association or cooperation with one or several R&D units;*

*b) not to exceed with this contract, including the possible renovations, an accumulated period of two years in this type of studentship, continuously or with interruptions.*

**Workplan:** Testing of natural  $\text{CaCO}_3$ -based materials in the Ca-looping process for thermochemical energy storage.

The research work to be developed falls within the scope of the activities provided for in tasks 1 and 2 of the research project approved by the FCT with the title “SoCaLTES- Solar-driven Ca-Looping Process for Thermochemical Energy Storage” and reference PTDC/EAM-PEC/32342/2017.

The recent and innovative application of the Ca-Looping (CaL) process integrated with solar energy concentration for thermochemical energy storage (TCES) is an interesting option, due to the low cost of natural geological CaO precursors, such as limestone, and their high energy density. The CaL used to capture  $\text{CO}_2$  and for TCES, is a reversible process and allows the use of the same material over several cycles, which increases the sustainability of the use of mineral resources, such as limestone and dolomite. When the reactivity of the CaL material becomes inadequate for the intended purpose, it can be incorporated into the clinker produced in the cement industry, i.e., the residues are valued as they become the raw material for cement.

The work to be developed has the following main objectives: selection and characterization of waste and natural resources for TCES based on  $\text{CaCO}_3$  materials, study of the reactivity, stability and abrasion resistance of the TCES materials for use in the CaL in both types of fixed bed and fluidized bed reactors at laboratory scale.

Different low cost solid CaO precursors of Portuguese origin will be selected, characterized and tested (marble powder wastes, water treatment sludge and natural geological resources such as dolomite and limestone). In the first part of the study, different experimental conditions and different materials will be tested using in-situ XRD and TGA techniques, to identify the deactivation mechanisms of materials for TCES throughout the cycles of the CaL process. The characterization of solid CaO precursors will be performed using advanced analytical techniques of  $\text{N}_2$ , adsorption, XRD, TGA, SEM, and Hg porosimetry.

In the second part of the work, studies of the reactivity, stability and attrition resistance of CaO solid precursors will be carried out using laboratory tests in fixed bed and fluidized bed reactors.

The work to be carried out and the objectives to be achieved in this work plan are relevant to the conclusion of the course that does not award an academic degree entitled “Scientific Research Methodologies and Techniques”, in which the scholarship holder is enrolled, because they include the use of several advanced scientific research techniques and methodologies such as in-situ XRD, TGA,  $\text{N}_2$  adsorption, XRD, TGA, SEM, and Hg porosimetry, which the student will use and interpret in the work that will be carried out.

**Legislation and Regulations:** Statute of Scientific Research Fellow, approved by Law nr. 40/2004, of August 18, as worded by Decree-Law nr. 123/2019, of August 28; FCT Regulation for Research Studentships and Fellowships, available on <https://www.fct.pt/apoios/bolsas/docs/RegulamentoBolsasFCT2019.pdf> and <https://dre.pt/application/file/a/127230968>.

**Workplace:** The work will be developed in the laboratories of the CATHPRO Research Group (Torre Sul - 9<sup>th</sup> Floor, Avenida Rovisco Pais, 1, 1049-001 Lisbon) at the Centro de Química Estrutural of IST-ID, Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento, under the scientific supervision of Dr. Paula Alexandra Lourenço Teixeira.

**Duration:** The research fellowship will have the duration of 6 months. It's expected to begin in November/2021, and may be eventually renewed up to the maximum of 12 months.

**Monthly maintenance allowance:** According to the values for Research Fellowships awarded by FCT in Portugal (<http://www.fct.pt/apoios/bolsas/valores>), the amount of the monthly maintenance allowance is €1104.64, being the payment method an option of the Fellow by Wire Transfer/Check.

**Selection methods:** The selection methods will be the following: *Curriculum Vitae* evaluation and individual interview (to be carried out in person or off-site through an online video conference platform), with the respective grades of 0 to 20 points attributed to each method and with the respective percentage weighting of 50% for each of the methods.

**Composition of the selection Jury:** Carla Isabel Costa Pinheiro; Henrique Aníbal Santos de Matos; Paula Alexandra Lourenço Teixeira.

**Announcement/ notification of the results:** The final evaluation results will be communicated to all applicants by email.

**Deadlines and procedures of complaint and appeal.** A complaint may be lodged from the final decision within 15 working days, or an appeal to the Executive Board of IST-ID within 30 working days, both counted from the respective notification

**Application deadline and formalization:** The call is open from 11 until 22 October 2021.

It is mandatory to formalize applications with the submission of the following documents: i) B1 Form – Fellowship application (<https://ist-id.pt/concursos/bolsas/>); ii) *Curriculum Vitae*; iii) academic degree certificate, where applicable; iv) proof of enrollment at an academic course that does not award an academic degree; v) motivation letter; vi) declaration on honour that the applicant does not exceed with this contract an accumulated period of two years in this type of studentship, continuously or with interruptions.

Applications must be submitted to the email: [carla.pinheiro@tecnico.ulisboa.pt](mailto:carla.pinheiro@tecnico.ulisboa.pt).