



*DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING FRAME
INFORMATION CALL 2021*

PhD POSITION OFFER FORM

Position URL: <https://finder.lacaixafellowships.org/finder?position=4238>

Position

1. Project Title/ Job Position title: Study of heat and mass transfer through firefighting protective clothing: development of an innovative firefighter jacket
2. Area of Knowledge: PHYSICAL SCIENCES, MATHEMATICS AND ENGINEERING
3. Group of disciplines: Chemistry and Chemical Engineering
4. Research project/ Research Group description

The current challenges imposed by extreme wildfires recently turn-out one of the key matters in European Governments' Agenda. In 2020, the **DIF-Jacket project (Development of an Innovative Firefighter Jacket;** <https://difjacketproject.fe.up.pt/>) emerges to minimize firefighters' on site injuries and fatalities through the proposal of a **novel high-performance jacket**. For the first time, a study **integrates the transient nature** of the fire scenarios and **behaviour actions** in the **Research & Development process** of an **innovative thermal protective jacket**. This multidisciplinary project is **coordinated by CEFT**, in collaboration with 2 textile Research Centers: **CeNTI** (Centre for Nanotechnology and Smart Materials) and **CITEVE** (Centro Tecnológico das Indústrias Têxtil e do Vestuário de Portugal).

The institutions have different backgrounds and they give complementary contributions. **CEFT (PhD host)** has vast **expertise in computational fluid dynamics** and **heat/mass transfer**; CeNTI has a long expertise and capacity for R&D on functional materials, namely multilayer systems construction through lamination and coating techniques as well as on surface functionalization or functional coatings; CITEVE has expertise in textile structure and garment construction and testing. Please see more information about the patterns in their websites (**additional websites section**).



A **numerical model of heat and mass transfer** through the protective equipment combined with a **thermoregulation model of the human body** has been developed to predict **firefighter thermal response** and to study **the stresses he will be exposed to** when facing a given forest fire scenario. The project also has a **strong dissemination** component to pass useful information to the Portuguese firefighting institutions and firefighter associations. The proposal research project includes the study of **new functionalities, innovative materials and integrated solutions** in order to produce a novel high-performance jacket.

5. Job position description

The PhD candidate will integrate the Transport Phenomena Research Center (**CEFT**) at the Faculty of Engineering of the University of Porto (**FEUP**). The candidate will participate on a challenging set of numerical activities of the DIF-Jacket project:

- i) Improvement of the in-house code to include different types of boundary conditions and different bioheat models
- ii) Screening of potential materials and solutions to be integrated in the firefighter jacket using the in-house simulation platform
- iii) Development of a full-scale tridimensional model of the protective clothing
- iv) Study of the spatial effects microclimate and anisotropic distribution of the new cooling/heat management system on firefighter thermal state

The candidate must have a background in **science or engineering**, with interest in transport phenomena and product performance optimization. The research team will provide training on **Numerical Simulation Platforms**. Previous experience in these fields and experience in programming will be advantageous to the candidate.

Furthermore, the candidate is expected to participate in the group activities (seminars, courses, conferences, etc.) and have regular meetings with his/her supervisor. The candidate will have the opportunity to travel to conferences to present his/her work and short stays in CEFT partner institutions.

Group Leader

1. **Title:** Prof.
2. **Full name:** João Bernardo Lares Moreira de Campos
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4. **Research project/ Research Group website (Url):** <https://difjacketproject.fe.up.pt/>
5. **Website description:** DIF-Jacket project



Additional website

1. Url: <https://paginas.fe.up.pt/~ceft/energy>
Website description: CEFT research in the Energy topic.
2. https://sigarra.up.pt/feup/en/CUR_GERAL.CUR_VIEW?pv_ano_lectivo=2019&pv_origem=CUR&pv_tipo_cur_sigla=D&pv_curso_id=684

Website description: Doctoral Program in Chemical and Biological Engineering; Interpersonal Skills lectures and Optional Units of study.
3. <https://www.centi.pt/en/home->
Website description: CeNTI partner: Centre for Nanotechnology and Smart Materials.
4. <https://www.citeve.pt/>
Website description: CITEVE partner: Centro Tecnológico das Indústrias Têxtil e do Vestuário de Portugal.