



PhD in CHIMICA INDUSTRIALE E INGEGNERIA

CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 37th cycle

THEMATIC Research Field: SAFETY OF LITHIUM-ION BATTERIES

Monthly net income of PhDscholarship (max 36 months)

€ 1325.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Electrification of road transport can significantly reduce greenhouse gas (GHG) emissions, which cause a global climate change. World-wide deployment of battery electric vehicles, powered by lithium-ion batteries, proceeds at an accelerating pace contributing to the effort of GHG emissions reduction. Contemporary lithium-ion batteries contain liquid electrolytes that are known to be flammable, corrosive and toxic. Their components can be hazardous to human health when released into ambient air, either due to a battery leakage or in a battery fire. Due to the relatively short history of electric vehicles on the road, experimental data on the dispersion of the electrolyte vapour clouds in (semi-)enclosed environments, such as parking garages and tunnels, is not readily available. Understanding of vapour cloud dispersion and evolution upon accidental electrolyte release is of crucial importance for the design of early warning systems, ventilation and other elements of signalling and hazard mitigation infrastructure. The focus of this work is on simulations of evaporation, dispersion and composition changes within an electrolyte cloud using computational fluid dynamics (CFD), which will further be supported experimentally.

Methods and techniques that will be developed and used to carry out the research

Computational Fluid Dynamics simulations (ANSYS Fluent or CFX) including species transport and energy balance Microsoft Excel and/or Matlab software. Thus,



	ability to perform Computational Fluid Dynamics simulations (ANSYS Fluent or CFX) including species transport and energy balance is required as well as a good knowledge of Microsoft Excel and/or Matlab software is an <u>essential requirement</u> .
Educational objectives	<p>The main objectives of the studies are:</p> <ul style="list-style-type: none"> • To gain an in-depth understanding of the dispersion of Li-ion battery electrolyte gas cloud under different conditions, including effects of temperature gradients, convection and variation in chemical composition of evaporating electrolyte. • To better estimate thermo-chemical characteristics of electrolyte components such as gas diffusion coefficients and dynamic viscosity, based on a combination of experimental studies and CFD simulations. • To provide science-based evidence on effective approaches for ensuring early detection of electrolyte leakage from Li-ion batteries in enclosed and semi-enclosed spaces, such as parking garages, tunnels, containers and cellars, hosting battery-propelled electric vehicles and stationary battery energy storage systems. <p>To formulate recommendations on potential (ventilation) strategies for risk mitigation in case of an accidental release of Li-ion battery electrolyte to ensure human safety and to minimise damage to infrastructure</p>
Job opportunities	The work is new and thus really interesting for the companies which produce lithium-ion batteries and in general for safety consultants
Composition of the research group	5 Full Professors 5 Associated Professors 1 Assistant Professors 18 PhD Students
Name of the research directors	Prof. Valentina Busini

Contacts
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<https://cfalab.chem.polimi.it/>

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	564.01 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Selection procedure

The doctoral student will be selected according to the following procedure:

1. Publication of a call for expression of interest.
2. Pre-selection by POLIMI ICCE PhD Commission.
3. Final selection by the JRC in agreement with POLIMI ICCE PhD Commission.

The resulting ranking list (a maximum of 5 candidates) defined by a Commission, appointed by POLIMI ICCE PhD Faculty Board and approved by POLIMI's Rector, will be sent to the JRC specialized Commission, with the candidates' applications, for the final selection. The JRC Commission will consist of three members appointed by the Head of the Energy Storage Unit. The JRC Commission will contact the pre-selected candidates for an interview. The ranking list of the pre-selected candidates will be published on the POLIMI PhD School web site (<http://www.dottorato.polimi.it>).

The publication on the Web site counts as official notification to candidates pursuant to the law. After the final interview, the JRC will contact each pre-selected candidate to inform about the outcome of their application; the successful candidate will then be contacted by a PhD School officer for the enrolment procedure.

Other information can be found at:

<https://ec.europa.eu/jrc/en/working-with-us/collaborative-doctoral-partnerships>

<https://recruitment.jrc.ec.europa.eu/>

Educational activities (funding for participation in courses, summer schools, workshops and conferences) - financial aid per PhD student per year:

1st year: -

2nd year: about 1.500 euros per student

3rd year: about 1.500 euros per student



Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD student: There are various forms of financial of the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation