



PhD in CHIMICA INDUSTRIALE E INGEGNERIA

CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 39th cycle

THEMATIC Research Field: MASS TRANSPORT DRIVEN BY THERMAL GRADIENTS

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

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

Titolo: Thermal Forces in confined fluids and soft solids
CUP:D53D23002090006
Codice Progetto: 20222MCY75
Decreto di Concessione: D.D. n. 104 of 02-02-2022

This project aims at investigating forces induced by thermal gradients by focusing on two main effects, thermo-osmosis in nanochannels and thermally-driven strain in soft solids. Thermo-osmosis, which consists in the onset of a stationary fluid flow induced by temperature, is also of great interest for applications in diverse fields, ranging from transport in fuel cells to the design of MEMS. We will perform an extensive experimental investigation of thermo-osmosis through microchannels.

Thermal gradients can also induce stresses leading to structural deformation in soft solids. Besides posing challenging questions about the elasto-plastic response to thermal gradients of soft solids, these observations open up the exciting chance of locally modifying their rheological properties, which is a goal of this project.

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

The investigation of thermally-induced stress in soft solids will be mainly performed by means of Photon Correlation Imaging, a novel optical technique that combines the power of Dynamic Light Scattering with that of optical



	<p>microscopy, and by investigating effects of thermal lensing induced in the solid by the absorption of an IR laser beam. Since these techniques will also be implemented in the COLIS module to be installed in the International Space Station (ISS) in 2024, the PhD student will also be involved in the analysis of microgravity data.</p> <p>To investigate thermo-osmotic phenomena in fluids, the PhD student will be involved in the design and test of a custom-made setup, allowing to measure pressure gradients between two reservoirs connected by microtubing and kept at different temperature.</p>
Educational objectives	The PhD student is expected to gain a substantial competence in optical methods and correlation techniques, analysis of data obtained on the ISS, numerical modeling of thermally inhomogeneous fluid and solid materials.
Job opportunities	<ul style="list-style-type: none"> •Academic research •Research within Space Agencies •R&D in companies developing fuel cells
Composition of the research group	1 Full Professors 1 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Roberto Piazza

Contacts
Telephone: 0223996386 Email: roberto.piazza@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	700.0 €
By number of months	6

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

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

1st year: around 1.900 euros per student

2nd year: around 1.900 euros per student

3rd year: around 1.900 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 for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities within the limits allowed by the regulation.