Would you like to be part of the team developing the first ion propulsion system in Spain?

ienai SPACE, an early stage startup located in Madrid, in collaboration with Institut Català de Nanociència i Nanotecnologia (ICN2) and Centro Nacional de Microelectrónica (CNM), are looking for an industrial PhD candidate in micro-fabrication in order to develop the first electric propulsion system designed and manufactured in Spain.

ienai SPACE is a highly innovative company in the “new Space” sector; the team is made up of a dynamic and multidisciplinary group of engineers, PhDs, developers and financial experts in ‘deep-tech’, looking to revolutionize the adoption of space propulsion products in the smallest satellites.

Micro-fabrication of ‘electrospray’ emitters for an electric space propulsion system

The objectives of the industrial PhD’s thesis will be to research, develop and optimize the appropriate techniques for micro- and nano-fabrication of the emitter component in an ‘electrospray’ propulsion system. ‘Electrospray’ thrusters are based on a physical phenomenon by which particles from an electrically conducting liquid may be evaporated and accelerated under electrostatic fields generated between an emitter array and an extraction grid. This process is governed by the surface tension and electrical conductivity of the liquid, as well as the peak electric field reached in individual emitters, for a given applied electric potential.

ienai SPACE has developed a 2nd generation prototype of its electrospray thruster ATHENA (Adaptable Thruster based on Electrospray for Nanosatellites), which is being tested in its in-house experimental vacuum facilities. The manufacturing of emitter arrays is done in collaboration with CNM and ICN2, taking advantage of novel micro-fabrication techniques. In order to reach an optimized version of the device, the design, manufacturing and testing of new emitter arrays is required; these should be capable of concentrating the electric field, maximizing the thrust density per area, facilitating the propellant feeding to individual emitters and minimizing the risks of electrochemical attacks.
Industrial PhD description

The PhD candidate will be responsible, under the supervision of the company team and a thesis advisor at ICN2, of the design and manufacturing of new electrostatic emitter arrays based on novel applications of established techniques in micro- and nano-fabrication. The candidate will perform an extensive bibliography analysis on ‘electrospray’ thrusters and their base physical processes; furthermore, this analysis will seek to map the different micro-fabrication techniques, approaches and results used for this type of applications, selecting those which show promising outlooks in producing the desired characteristics in the emitter by which to obtain the sought after emission regime. The PhD candidate will propose the study of the particular design space with regard to the relevant emitter parameters, in order to manufacture and test a number of emitter arrays, allowing to establish the scaling laws for these devices. In particular, varying configurations of emitter packing strategies, relative distances between individual emitters, height of micro-structures, taper angle, etc. The candidate will develop the know-how and skills required to lead the micro-fabrication of these emitter arrays; including: design of micro-lithography masks in AutoCAD (or similar), lithography processes required to deposit and etching of the photosensitive resins on silicon wafers (or other materials), wet/dry etching processes on wafers and subsequent nano-texturing or nano-deposition processes. The geometric characterization of emitters will be performed through visual means through electron microscopy or LASER based methods. Furthermore, the PhD candidate will be responsible for characterization of the propulsive performances of the emitter arrays; said tests will be carried out in the in-house experimental vacuum facilities of ienai SPACE, making use of the diagnostics developed for these particular types of thrusters.

The candidate will be selected on the basis of the skills and previous know-how described next (in any case, it is not expected that candidates meet all requirements; candidates which are highly motivated and which can demonstrate a high capacity to learn are preferred over those which only demonstrate previous experience):

- Microfabrication background (lithography, etching, wet/dry micromachining theory and processes)
- Practical, hands-on experience in clean-room environments
- Software skills: AutoCAD or similar
- Spoken and written proficiency in English language
- Capacity for fast learning
- Proactiveness and capacity for independent work

Contact

Candidates can send their CV and a short description of the candidate’s motivation to join the project to saracp@ienai.space under the subject “industrial PhD microfabrication”