

# JOB POSTING

**Recruiting organisation:**

Fraunhofer Institute for Chemical Technology  
ICT, Germany

**Subproject title:**

Reaction process screening and monitoring

**Starting date:**

1st September 2023 (or earlier if preferred)

**Salary:**

The Doctoral Network "MiEI" is financed by the European Union under the framework of the program HORIZON Europe, Marie Skłodowska-Curie Actions. The doctoral candidate will be hired for 36 months under contract by the Fraunhofer-Gesellschaft e.V., Fraunhofer-Institut für Chemische Technologie, with a monthly gross salary of approx. 3200 € (including mobility allowance, but excluding other allowances that depend on eligibility, e.g. family allowance, special needs allowance).

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**Background information:**

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Marie Skłodowska-Curie Doctoral Networks are joint research and training projects funded by the European Union. Funding is provided for doctoral candidates from both inside and outside Europe to carry out individual project work in a European country other than their own. The training network "MiEI" is made up of 10 partners, coordinated by Fraunhofer ICT in Germany. The network will recruit a total of 12 doctoral candidates for project work lasting for 36 months.

New industrial production strategies like "production on demand" and "Industry 4.0" are increasing the demand for new digital concepts for the chemical industry that are easily scalable and can work like a construction kit. In addition, the reduction of fossil fuel consumption requires novel synthesis concepts with on-demand capabilities paired with the use of electrical

energy as a primary source for chemical processes.

MiEI will address this demand from the chemical industry, combining the advantages of electrochemistry, micro process engineering and flow chemistry. The recruited researchers will explore new models for electrodes and electrochemical flow cells, and develop innovative integrated prototype cells using printed circuit board (PCB) technology as a mass-scalable and flexible tool. These cutting-edge technologies will be applied to promising fine chemical and pharmaceutical synthetic routes, which will be further accompanied by techno-economic evaluation defining new business opportunities. The new MiEI technologies and processes will allow safe, flexible and sustainable synthetic routes for the chemical industry of the future.

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**Job description:**

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The advertised subproject is fully funded by the Marie Skłodowska-Curie European Training Network „MiEI“. It will be carried out by one doctoral candidate at the Fraunhofer Institute for Chemical Technology ICT (PhD supervision Karlsruhe Institute of Technology) over a period of 36 months.

The Fraunhofer Institute for Chemical Technology ICT is one of about 70 Fraunhofer institutes in Germany. Two complementary departments are involved in the project. The department for Applied Electrochemistry covers research on secondary batteries, fuel cells, redox flow batteries, electrosynthesis and electrochemical sensors. The chemical processing technology group is active in the field of chemical synthesis, process development, process optimization and process analysis based on continuous processing and micro process engineering.

The recruited researcher will develop novel automated screening methodologies to perform self-optimization of continuous electrosynthesis processes. Based on mathematical optimization algorithms, the systems will autonomously direct

reactions to a previously defined target function, e.g. the maximum yield and productivity of a transformation or a desired product distribution. Substituting classical one-factor-at-a-time (OFAT) or even design-of-experiments (DoE) methods by evolutionary algorithms results in a significant reduction of labor-intensive processes and an accelerated development.

To achieve this, the researcher will set up a laboratory screening system including a microfluidic electrochemical flow cell. She/he will test and evaluate appropriate inline chemical monitoring tools, preferably vibrational spectroscopy (IR, Raman) or in-line nuclear magnetic resonance (NMR) spectroscopy, and implement a laboratory scale process control and automation methodology with integrated feedback control. This system will be extended by mathematical optimization algorithms in order to realize self-optimization of flow processes regarding different target functions. The developed methodology will be applied for the reaction screening and optimization of use case processes within the MiEI project.

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### **Benefits:**

The recruited researcher will have the opportunity to work as part of an international, interdisciplinary team of 12 doctoral candidates, based at universities and industrial firms throughout Europe. She/he will be supported by two mentors within the MiEI project, and will have multiple opportunities to participate in professional and personal development training. Through her/his work she/he will gain a unique skill-set comprising electrosynthesis, flow chemistry and process analytical technologies, as well as modern control engineering techniques. She/he is expected to finish the project with a PhD thesis and to disseminate the results through patents (if applicable), publications in peer-reviewed journals and presentations at international conferences.

All employees at Fraunhofer ICT benefit from flexible working hours and the option to work

from home. Fraunhofer supports an optimal balance between family and career.

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### **Requirements:**

#### ***Qualifications / experience:***

- In accordance with the European Union's funding rules for doctoral networks, applicants must NOT yet have a PhD
- Excellent Masters degree, preferably in chemical engineering.
- Strong interest in electrochemistry and experimental cross-disciplinary work at the interface of chemistry, control engineering / automation and process analytics
- Significant laboratory experience, ideally also in the field of flow chemistry
- Working knowledge in the field of measurement technology and automation tools (e.g. lab view) as well as programming (e.g. Python, MatLab)
- Significant math and analytical skills including experience with data collection, programming and data analysis
- Familiarity with lab equipment, including chemical handling procedures and attention to detail as well as environmental, health and safety (EHS) requirements
- Excellent communication skills and willingness to work in collaborative projects with multiple partners
- Ability to speak effectively in front of large groups (conferences, project meetings, customers)
- Very good English language skills (German is beneficial)
- Self-motivation and the ability to achieve goals independently as well as to contribute effectively to the team

#### ***Mobility:***

The applicant must not have resided or carried out her/his main activity (work, studies etc.) in Germany for more than 12 months in the past 3 years.



Doctoral network for microprocess  
engineering for electrosynthesis

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**How to apply:**

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Please send your CV by e-mail (preferred) or by post, quoting the reference „MiEI 2DC-ICT“:

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Joseph-von-Fraunhoferstraße 7  
76327 Pfinztal, Germany

**Application deadline:** 15<sup>th</sup> March 2023