2023 Helmholtz – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project:

Synergetic Redox Reaction in Tandem on Membrane Support for Efficient Removal on Refractory Organics

Helmholtz Centre and/or institute:

Karlsruhe Institute of Technology (KIT)
Institute for Advanced Membrane Technology (IAMT)

Project leader:

Prof. Dr.-Ing Andrea Iris Schäfer

Contact Information of Project Supervisor: (Email, telephone)

andrea.iris.schaefer@kit.edu;

Tel.: +49 (0)721 608 26906

Web-address:

http://iamt.kit.edu/

Department: (at the Helmholtz centre or Institute)

Institute for Advanced Membrane Technology (IAMT)

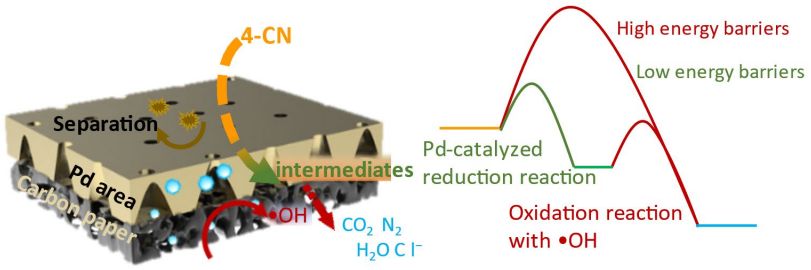
Programme Coordinator (Email, telephone and telefax)

Karlsruhe Institute of Technology (KIT)
International Affairs
Name: Oliver Kaas
Kaiserstr. 12, 76131 Karlsruhe
Phone: + 49 721 608-45323 Telefax: 0721 60845326
Email: oliver.kaas@kit.edu

Description of the project (max. 1 page)**:**

Access to clean and affordable water free from chemical and biological contaminants remains one of the most critical global challenges of the 21st century, which is difficult to address adequately by conventional water treatment processes. Advanced oxidation processes (AOPs) are considered as a one of the most effective methods for the removal of organic pollutants. These processes are mainly based on non-selective character of reactive oxygen species with high oxidation potential, such as hydroxyl radicals (•OH), sulfate radicals (SO_4•$^-$) and singlet oxygen ($^1O_2$). However, there are some persistent refractory organics (such as chlorinated or perfluorinated organic micropollutants) that cannot be effectively degraded by single oxidation process due to their high reaction energy barrier.

Most importantly, these substances would pose great adverse health risks, once entered into the environment, because of their significant toxicity at even low concentrations.



Tandem catalysis can be a promising approach for the effective and complete elimination of the most persistent refractory organics, which integrated multiple consecutive chemical reactions under similar or identical conditions in a single catalytic system in a membrane support. The refractory organics would be transformed to some certain intermediates with lower reaction energy barriers, then immediately degraded by reactive oxygen species and be further converted to H_2O, CO_2, and other harmless products. The reaction occurs in membrane pores, which accelerates mass transfer and hence apparent kinetics. Therefore, the rational design on tandem catalytic process could meet the effective removal on refractory organics with lower energy consumption. The key to obtain such a high-efficiency catalytic system is the design and synthesis of highly performing bi- and multi-functional catalysts or interface with controlled active components and ideal spatial distributions.

Redox synergy has been found to achieve efficient removal of the chlorinated organics (such as *p*-chloroaniline). Electrochemical process holds the potential to build a redox synergistic reaction system, for the simultaneous generation and coexisting of both reductive and oxidizing species. The goal of the candidate will be to design and build a platform to take the advantage of this process intensification strategy for the efficient removal of refractory organics. The candidate will be fully supported by our team and work in a synergistic approach with benefiting from a variety of sound experimental methods and cutting-edge analysis and testing tools. The results of the candidate will be expected to advance the research of the tandem catalysis in environmental application.

Description of existing or sought Chinese collaboration partner institute (max. half page)**:**

IAMT is open to new collaborations from within China with a focus on membrane technology.

Required qualification of the postdoc:

The ideal candidate will hold a PhD in Chemical, Process, Environmental, Materials Engineering, or equivalent and is a naturally curious 'can do' person, eager to learn more and has a strong interest in research. Experience with membrane filtration is a requirement and photo and electrocatalytic membrane systems (of any scale) a definite advantage. The choice and integration of tandem catasysts in a membrane support will require sound material expertise. Further requirements are experience in specifying system components, sound experimental problem-solving skills, micropollutant/water analysis and a solid publication track record – as well a good common sense. Excellent English language proficiency is essential (IAMT is English speaking), basic German language skills of advantage. A valid driver's licence is required.

Please send applications with cover letter addressing position requirements, CV, publication list and your contribution to the publication (if relevant), academic transcripts, degree certificates, contact details for three references and a preliminary research proposal on the topic to the above contact(s). It is strongly advised to visit the IAMT website as well as read the numerous publications on the topic.

KIT – International Affairs (INTL) Contact: Oliver Kaas Phone: +49 721 608 45323 Email: oliver.kaas@kit.edu