Helmholtz - OCPC - Programme 2017-2021

for the Involvement of Postdocs in Bilateral Collaboration Projects with China

PART A

Title of the project

Towards Fully Scanning Probe Lithography Printed Electronics

Helmholtz Centre and institute:

Karlsruhe Institute of Technology (KIT), Institute of Nanotechnology (INT)

Project leader:

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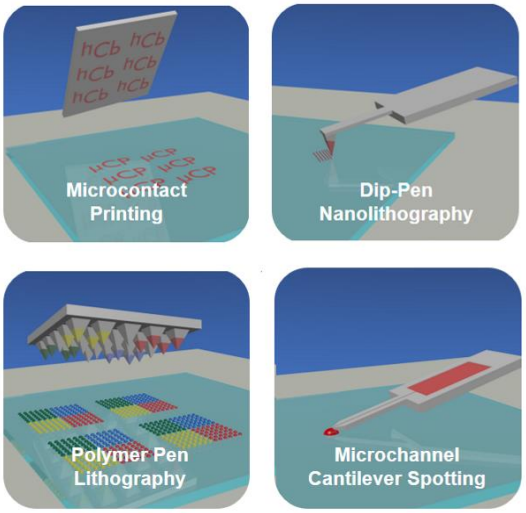
Description of the project:

Fascinating progress has been achieved in recent years in the field of nanolelectronics, in particular the use of 2D materials (graphene, boron nitride, dichalcogenides) and a beginning transition from classical lithography to additive techniques (printed electronics). However, there are still challenges, especially in the automation of subsequent process steps in additive manufacturing and in the resolution that can be obtained in e.g. ink jet based approaches.[1]

Scanning probe lithography (SPL) methods like dip-pen nanolithography (DPN), polymer pen lithography (PPL) or spotting via microchannel cantilever (µCS) have shown big potential for high resolution patterning and highly localized functionalization of existing structures and devices.[2] This makes them ideal candidates for further improvement and development in printed electronics. Our group has a strong track record in the use of SPL methods for bioactive surfaces and sensor functionalization and machine development for implementation of SPL methods and realization of integrated setups (resulting in a recent company spin off, n.able GmbH).[3-7]



We want to leverage our experience in the field to further dive into the area of printed electronics and bring the full potential of SPL methods to fruitful application here.

As part of this effort, a PostDoc project in the framework of the Helmholtz-OCPC-Programme is proposed, that will demonstrate the potential of such methods by developing a fully SPL printed FET based biosensor. Here, the mild process parameters and additive character of the SPL methods (no organic solvents required, maskless, additive and digital, full multiplexing) can synergistically be used in all process steps from the initial preparation of 2D materials, over contacting and final application of a sensing element in form of delicate sensor molecules.

The implementation of the project will – in addition to the immediate outcome of demonstrating the fully SPL printed FET biosensor – further the cooperation between KIT and the Chinese partner institute for additional and continued collaboration in the context of the future printed electronic research and development.

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

We already have contacts to two Chines partner institutes that could potentially act as partners in the project:

Institute of Functional Nano & Soft Materials (FUNSOM) at Soochow University
The Functional Nano & Soft Materials Laboratory (FUNSOM) was founded at Soochow University on June 9th, 2008, and is led by the founding director, Prof. Shuit-Tong Lee, an academician of the Chinese Academy of Sciences (CAS). In April 2010, it was renamed as Institute of Functional Nano & Soft Materials (FUNSOM). On the basis of FUNSOM, the College of Nano Science and Technology (CNST) was founded in December 2010, and was soon approved as one of the 17 National Pilot Colleges by the Ministry of Education.
At present there are 41 principal investigators conducting interdisciplinary and innovative research in different areas of nano-science and technology, including nano-optoelectronics, nano-energy, nano-biotechnology, and nanoscale interface sciences. To date FUNSOM has received over 650M RMB ($101.83M) in competitive national funding from NSFC,
MOST and other national agencies.

Shanxi Key Laboratory of Interface Science and Engineering in Advanced Materials at Taiyuan University of Technology (TYUT)
Taiyuan University of Technology (TYUT) is a national “double-first rate” key university. After 116 years of development, TYUT has become an institution of higher learning with a focus on engineering, a combination of science and technology and a coordinated development of multiple disciplines.
With the globalized vision and international exchange, TYUT has consistently accelerated the international cooperation and communication. Programs of various levels and modes and mutual education have been in effect with many universities and colleges from the U.S., Japan, the U.K., Australia, Canada, Germany, Russia, France, Italy and others. The more frequent international communication at higher academic level has helped upgrade TYUT’s reputation both at home and abroad.

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Required qualification of the post-doc:

- PhD in Physics, Chemistry or related subject
- Experience with 2D materials, nanolithography, nanoelectronics
- Additional skills in atomic force microscopy (AFM), scanning probe lithography (SPL) methods like dip-pen nanolithography (DPN), microcontactprinting (µCP)

PART B

Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station in China, which is affiliated to a research institution like a university:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae, copies of degrees
- List of publications
- 2 letters of recommendation
- Proof of command of English language

PART C

Additional requirements to be fulfilled by the post-doc:

- Max. age of 35 years
- PhD degree not older than 5 years
- Very good command of the English language
- Strong ability to work independently and in a team

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