2020 HGF – GSI – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

Title of the project:

Fabrication of metal-organic framework nanowire assemblies

Helmholtz Centre and institute:

GSI Helmholtz Centre for Heavy Ion Research

Project leader:

Maria Eugenia Toimil-Molares

Contact Information of Project Supervisor:

m.e.toimilmolares@gsi.de, +496159711807

Web-address

https://www.gsi.de/en/work/research/appamml/materials_research.htm

Department

Materials Research

Programme Coordinator (Email, telephone and telefax)

Dr. Pradeep Ghosh
FAIR/GSI - International Programme for Students and Researchers (INTL)
Phone: +49 6159 71-3257
Email: Pradeep.Ghosh@fair-center.eu / International@gsi.de

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

The control over the size and shape of nanoMOFs is essential for their exploitation in integrated devices such as sensors, membranes for gas separation, photoelectrodes, etc. Within this project, three-dimensionally interconnected nanowire networks of metal–organic frameworks (MOFs) will be fabricated by a combination of ion-track technology and electrochemical methods.

Recently, we demonstrated that Cu nanowires and nanowire networks electrodeposited inside polymeric etched ion-track membranes could be subsequently converted by electrochemical oxidation into different Cu-based MOFs such as e.g. $Cu_3(BTC)_2$ (also known as HKUST-1), and $Cu(INA)_2$ (Fig. 1). The polymer membranes are fabricated at GSI by swift heavy ion irradiation and chemical etching. Density, diameter, and geometry of the channels are adjusted during fabrication, and the MOFs, which are formed inside the channels, adopt their exact shape and size.

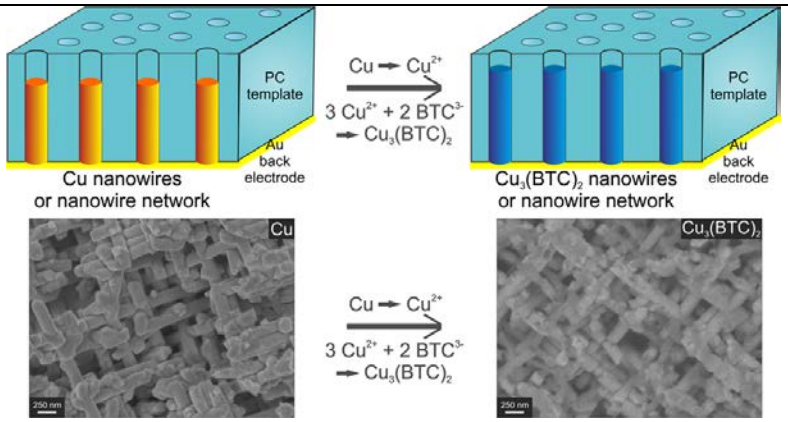

Fig. 1. (Top) Schematic representation of the two-step synthesis process used for the formation of $Cu_3(BTC)_2$ MOF nanowires, including Cu nanowire growth via cathodic electrodeposition and anodic conversion of Cu nanowires to $Cu_3(BTC)_2$ nanowires. (Bottom) Scanning electron microscopy images of a Cu nanowire network before and after its transformation to $Cu_3(BTC)_2$ MOF. Image adapted from Caddeo et al. ACS Appl. Mater. Interfaces 11 (2019) 25378.

The project tasks include:

- Synthesis of etched ion track membranes by swift heavy ion irradiation and etching
- Electrochemical synthesis of metal and MOF nanowires
- Characterization by various techniques including X-ray diffraction, scanning and transmission electron microscopy, etc.
- Investigation of the properties of the MOF nanostructured samples

Required qualification of the post-doc:

- PhD in Physics, materials research, or Chemistry
- Experience with materials characterization techniques
- Language requirement: fluent English (spoken and written)
- Proficient written and verbal communication skills as reflected in effective presentations at seminars, meetings and/or teaching lectures.
- Motivation and interpersonal skills to work in a collaborative, multidisciplinary team environment.