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FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR
Chemical and Biological Sciences

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SPEAKER

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TITLE OF THE TALK

Side Chain Functionalized Covalent Organic Frameworks –From Facilitated Delamination to Property Engineering

ABSTRACT

Covalent Organic Frameworks are a class of porous, crystalline materials constructed from highly symmetric organic building blocks via dynamic bond formation chemistry. The building blocks can be bridged via a multitude of different bond types, but arguably the most prevalent one is the imine bond, which can be formed by the condensation of aldehydes with amines. Although interest in three dimensional COFs is high and the number of examples is growing, layered two dimensional (2D) covalent-organic frameworks are the predominantly reported class of COFs. Commonly, through the ordered stacking of the 2D layers, frameworks with 1D channels are obtained. Due to their layer stacked nature, there is a growing interest in their delamination, since they can be viewed as porous analogues of more traditional 2D materials like graphene or hexagonal boron nitride. [1] The targeted delamination of such frameworks is still challenging, but solvent-assisted delamination methods offer a facile way to achieve few layer 2D dimensional COFs. Within this contribution recent progress in the preparation of side chain modified COFs will be presented. [2] The COFs under discussion are prepared from different tetratopic linkers connected via amines (pyrene, porphyrin), linked via imine bridges with terephthalic aldehydes functionalized with alkoxy side chains in 2,5-position. The nature of the attached side chain (chain lengths, branched vs linear) and the solvent during ultrasonic treatment have a crucial impact on the delamination. It was possible to exfoliate the prepared COFs into nanosheets as thin as 1.5 nanometers (4-5 layers). Furthermore, when long side chains are attached, the materials form stable dispersions, which were used to integrate the COFs into membranes used as separators in lithium ion and lithium sulfur batteries. Furthermore, the porphyrin derived COFs show promising properties as active materials for the electrochemical detection of urea. Lastly, the attachment of the side chains to the porous, layered framework materials had a drastic influence on the surface properties of the generated COFs, turning them from hydrophilic (without functional groups) to hydrophobic. This was proven on the one hand through vapor sorption experiments (heptane, water), as well as dynamic contact angle measurements. The functionalized materials repel water, while taking up heptane. This property allowed to use the prepared materials for absorptive oil-water separation.

References:
[1] A. Schneemann, R. Dong, F. Schwotzer, H. Zhong, I. Senkovska, X. Feng, A. Schneemann, Chem. Sci.2021, 11, 1600-1619.
[2] A. De, S. Haldar, S. Michel, L. Shupletsov, V. Bon, N. Lopatik, L. Ding, L. Eng, G. Auernhammer, E.Brunner, A. Schneemann, Submitted

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