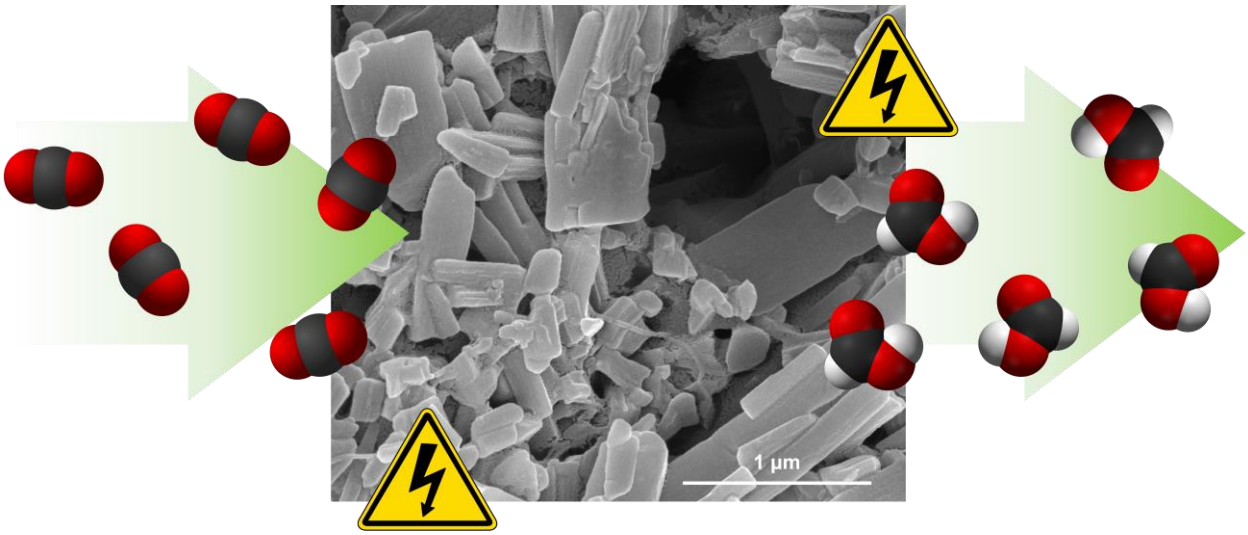
Bismuth-Based Metal-Organic Frameworks for Electrocatalytic CO_2 Conversion to Formate

Paolo Lamagni, Matteo Miola, Xin-Ming Hu, Kim Daasbjerg, Nina Lock, Troels Skrydstrup

Carbon Dioxide Activation Center (CADIAC), Interdisciplinary Nanoscience Center (iNANO) and Dept. of Chemistry, Aarhus University, Gustav Wieds Vej 14, DK-8000 Aarhus C, Denmark
lamagni@inano.au.dk

Carbon dioxide is an abundant and inexpensive substrate to produce industrially important and valuable compounds, such as fuels or precursors for polymers and pharmaceuticals. Over the last few years significant knowledge has been acquired on the development of bismuth-based materials for the electrocatalytic reduction of CO_2 to carbon monoxide and formate, based on metallic bismuth or its oxides and sulphides. [1-3] Additionally, metal-organic frameworks (MOFs) have gained attention due to their hybrid organic-inorganic structures, allowing for simultaneous tunability of their porosity and chemical behaviour, which may potentially lead to a broad range of applications. [4-6] In this work, we prove that, despite being poor candidates for electrochemical reactions due to their generally low electronic conductivity, MOFs can be used as precursors to form electrocatalytically active materials for CO_2 reduction. In particular, we have investigated Bi-based MOFs forming porous coatings on glassy carbon substrates, which produce formate from CO_2 in aqueous electrolyte with selectivity as high as 97% and current density as high as 10 mA cm^{-2}.



Schematic representation of CO_2-to-formate conversion on a Bi-MOF electrode surface, displayed through a SEM image of an actual film.

References:
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