# Towards rational catalyst design? 2D frameworks as platforms for light-driven hydrogen evolution

**Bettina V. Lotsch**[1]

[1] *Max Planck Institute for Solid State Research, Heisenbergstraße 1, 70569 Stuttgart*

*E-mail: b.lotsch@fkf.mpg.de*

The conversion of sunlight into storable chemical fuels through photocatalysis has been identified as a viable strategy to alleviate future energy shortage. Although a number of potent semiconductors for solar water splitting are at hand, key features such as earth-abundance, stability and low toxicity still need to be addressed, thus calling for new and flexible material solutions for sustainable photocatalysis. We have recently introduced covalent organic frameworks (COFs) and related 2D polymers as a new generation of molecularly tunable, earth-abundant photocatalysts that combine the stability of heterogeneous systems with the single-site definition of homogeneous catalysts (Fig. 1).[1] In this talk, I will outline our recent progress in carving out structure – property – activity relationships in 2D framework materials and discuss possible catalyst optimization strategies – structure, morphology[2,3] and reactivity engineering[4,5,6] – and challenges lying ahead in this emerging field of "soft photocatalysis".

.

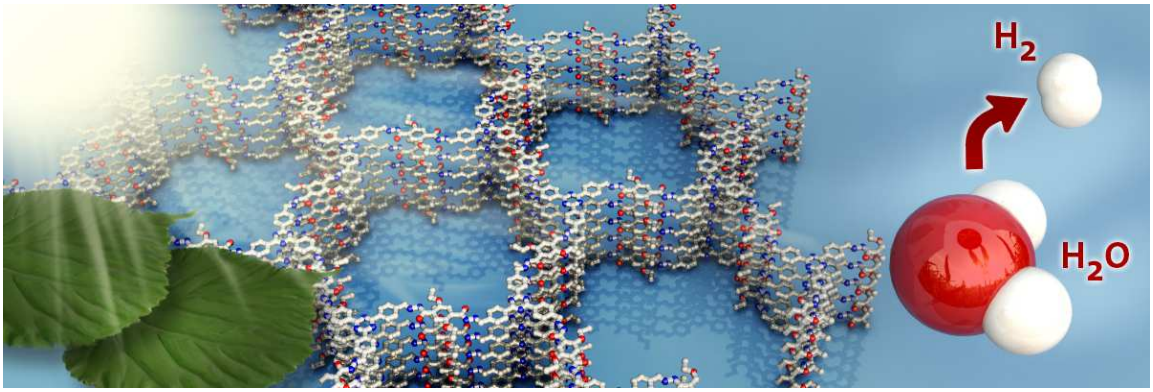


Figure 1. Sketch of a hydrazone-based covalent organic framework used as a photocatalyst for the hydrogen evolution reaction.

**Funding:** ERC Starting Grant (Grant number 639233)

**References:**

[1] L. Stegbauer, K. Schwinghammer, B. V. Lotsch, *Chem. Sci.* **2014**, 5, 2789

[2] V. S. Vyas, F. Haase, L. Stegbauer, G. Savasci, F. Podjaski, C. Ochsenfeld, B. V. Lotsch, *Nat. Commun.* **2015**, 6, 8508

[3] K. Schwinghammer, M. B. Mesch, V. Duppel, C. Ziegler, J. Senker and B. V. Lotsch, *J. Am. Chem. Soc.* **2014**, 136, 1730

[4] V.W.-h. Lau, I. Moudrakovski, T. Botari, S. Weinberger, M.B. Mesch, V. Duppel, J. Senker, V. Blum, B.V. Lotsch, *Nat. Commun.* **2016**, 7, 12165

[5] H. Kasap, C. Caputo, B. Martindale, R. Godin, V.W.-h. Lau, B.V. Lotsch, J. Durrant, E. Reisner *J. Am. Chem. Soc.* **2016**, 138, 9183

[6] V. W.-h. Lau, D. Klose, H. Kasap, F. Podjaski, M.-C. Pigne, E. Reisner, G. Jeschke, B. V. Lotsch, *Angew. Chem. Int. Ed. Int. Ed.* **2017**, 56, 510