Hexaazatriphenylene Doped Poly(heptazine imide) – Superior Photocatalyst for Oxidative Reactions

Bogdan Kurpil, Aleksandr Savateev, and Markus Antonietti

Max-Planck Institute of Colloids and Interfaces, Department of Colloid Chemistry, Research Campus Golm, 14424 Potsdam, Germany

E-mail: Bogdan.Kurpil@mpikg.mpg.de

Recently discovered class of carbon nitrides - potassium poly(heptazine imides) (PHIK), products of pyrolysis of triazoles or tetrazoles in eutectic mixture of KCl/LiCl, are highly crystalline polymers with unusually high (+2.54eV) valence band potential[1,2]. Such high valence band maximum makes these materials efficient for photocatalytic water oxidation (i.e. oxygen liberation) even without noble metal co-catalysts. Introduction of redox sites into poly(heptazine imide) structure will lead to improvement of photocatalytic activities. Derivatives of hexaazatriphenylene (HAT) are promising units for such doping due to their strong electron acceptor properties.

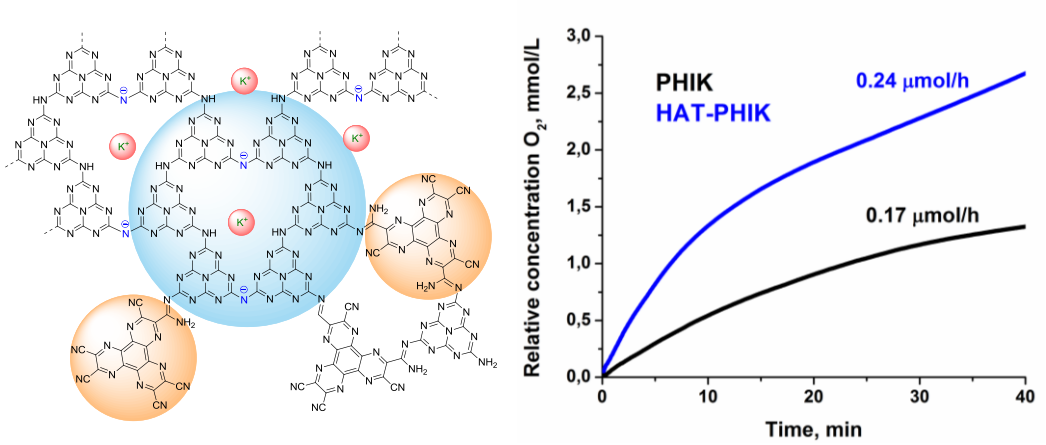

Figure 1. a) Structure of HAT-modified PHIK. b) Time dependent OER profiles.

The modification with such acceptor molecules was indeed found very efficient to obtain electron deficient semiconductors (Figure 1a). HAT-doped PHIKs possess lower valence band position (2.6eV) and narrower optical bandgaps (1.55-1.92eV), consequently demonstrate a higher activity in the photochemical liberation of oxygen from water (Figure 1b) and could be promising for photocatalytic oxidation reactions[3].

Acknowledgement: The authors are grateful the technicians of the Colloid Chemistry department for their contribution and Max Planck Society for financial support.

References:

[1] D. Dontsova, S. Pronkin, M. Wehle, Z. Chen, C. Fettkenhauer, G. Clavel, M. Antonietti, Chem. Mater., **2015**, 27, 5170-5179

[2] A. Savateev, S. Pronkin, J.D. Epping, M. Willinger, C. Wolff, D. Neher, M. Antonietti, D. Dontsova, ChemCatChem, **2017**, 167–174.

[3] A. Savateev, D. Dontsova, B. Kurpil, M. Antonietti, *J. Catal.* **2017**. 10.1016/j.jcat.2017.02.029