

Enhanced H₂O₂ Production via Photocatalytic O₂ Reduction over Tailored Poly(heptazine imides) Spheres

Lingli Ni¹, Erik Troschke¹, Alexander Lange², Dariusz Mitoraj², Radim Beranek², Martin Oschatz¹

¹Friedrich Schiller University Jena, Center for Energy and Environmental Chemistry Jena, Institute for Technical Chemistry and Environmental Chemistry, Philosophenweg 7a, 07743 Jena, Germany

²University of Ulm, Institute for Electrochemistry, Albert-Einstein-Allee 47, 89081 Ulm, Germany

E-Mail presenting author: lingli.ni@uni-jena.de

The utilization of carbon nitride materials is significantly constrained by their inherently low surface area (SA), low charge carrier mobility between adjacent layers and low electronic conductivity.^[1] Specifically, introducing porosity to the ionic derivatives of carbon nitrides, such as poly(heptazine) imides, proves challenging due to the high-temperature ionothermal process yielding more regular structure during its synthesis.^[2] This study introduces a novel synthetic strategy for porous hollow poly(heptazine) imide spheres (KPHIS) via a hard-templating method.^[3,4] KPHIS exhibit significantly higher SA with tunable shell thickness, improved visible light absorption, and enhanced hydrophilicity compared to the bulk material. The increased SA facilitates the intercalation of metal cations with a higher content and the channel system of PHIS is able to accommodate various cations into the structure, resulting in the changes in morphology, structure and optical properties. It allows for enhancing the catalytic performance for H₂O₂ production from O₂ reduction under visible light.

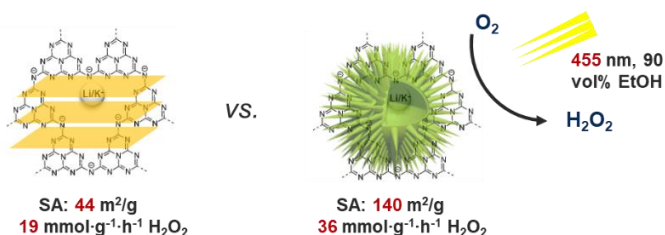


Figure 1: Comparison of structure, SA and H₂O₂ production between bulk KPHI and KPHIS.

[1] X. Wang *et al.*, ACS Catal. 2012, **2**, 1596. DOI. 10.1021/cs300240x

[2] Y. Wang *et al.*, Angew. Chem. Int. Ed. 2012, **51**, 68. DOI. 10.1002/anie.201101182

[3] J. Sun *et al.*, Nat. Commun. 2012, **3**, 1139. DOI. 10.1038/ncomms2152 (2012)

[4] J. Kröger *et al.*, Adv. Mater. 2022, **34**, 2107061. DOI. 10.1002/adma.202107061