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Sulfur-doped carbon nitride hybrid materials tested under green light for photoelectrocatalytic benzylamine oxidation and oxygen evolution reactions

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High-performing materials will dictate the pace of reinventing industrial chemical processes to achieve carbon neutrality [1]. Visible-light photoelectrocatalysts from abundant resources will play a key role in exploiting solar irradiation [2]. Anionic doping via pre-organization of precursors and further co-polymerization creates tuneable, extrinsic semiconductors. Triazole derivative-purpald, an unexplored precursor with sulfur (S) container, combined in different initial ratios with melamine during one solid-state polycondensation with two thermal steps yields hybrid S-doped carbon nitrides (C_3N_4).

The series of S-doped/C_3N_4-based materials showed enhanced optical, electronic, structural, textural, and morphological properties and exhibited higher performance in organic benzylamine photooxidation, oxygen evolution, and similar energy storage (capacitor brief investigation) [3]. 50M-50P exhibited the highest photooxidation conversion yield (84±3%) of benzylamine to imine at 535 nm – green light for 48h (**Figure 1**), due to an extra discrete shoulder reaching ~700 nm, an unusual high sulfur content, preservation of crystal size, new intraband energy states, rare deep structural defects by layer distortion, hydrophobic surface, low porosity, and 10-16 nm pores. An in-depth analysis of S doping was investigated coupling x-ray photoelectron spectroscopy, transmission electron microscope, and elemental analysis, providing insights on bonds, distribution, and surface/bulk content. This work contributes to the development of disordered photocatalysts with long-visible-light range for solar energy conversion and storage.

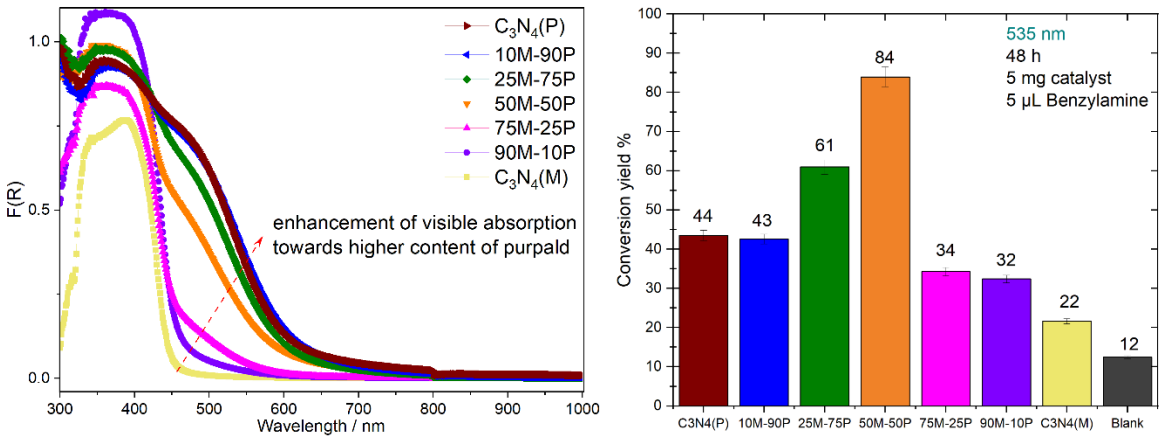

Figure 1. **Left)** Kubelka-Munk UV-vis spectra. **Right)** Photooxidation of benzylamine including the reaction conditions.

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