

Hybrid photoanodes for visible light-driven water splitting  
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The development of photochemical systems capable of splitting water into hydrogen and oxygen has attracted significant interest motivated by the need to secure the future supply of clean and sustainable energy [1]. Due to the complex chemistry involved in four-electron oxidation of water to dioxygen [2], the major challenge in photoelectrochemical water splitting is the development of cheap, efficient and stable photoanodes. Recently, we have been developing photoanodes based on a novel class of visible-light photoactive inorganic/organic hybrid materials – TiO<sub>2</sub> modified at the surface with polyheptazine (also known as “graphitic carbon nitride”). As we have shown, the optical absorption edge of the TiO<sub>2</sub>-polyheptazine hybrid is red-shifted into the visible (2.3 eV; ~540 nm) as compared to the bandgaps of both of the single components – TiO<sub>2</sub> (3.2 eV; ~390 nm) and polyheptazine (bandgap of 2.9 eV; ~428 nm), which is due to the formation of an interfacial charge-transfer complex between polyheptazine (donor) and TiO<sub>2</sub> (acceptor) [3]. In other words, the direct optical charge transfer leads to generation of electrons with a relatively negative potential in the conduction band of TiO<sub>2</sub>, while the holes photogenerated in the polyheptazine layer can drive photooxidation of water, as evidenced by visible light-driven evolution of dioxygen on hybrid electrodes modified with iridium or cobalt oxide nanoparticles acting as oxygen evolution co-catalysts [3-5]. Importantly, polyheptazine is highly stable, and at the same time it offers a possibility for further functionalization with transition metal-based catalytic sites enabling chemical transformations along multi-electron pathways. Our current attempts at improving the efficiency of kinetic charge separation in such hybrid photoanodes will be discussed.

#### References

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