Polyelectrolyte Layer-by-Layer Chromophore-Catalyst Assemblies for Light-Driven Water Splitting

Scientific Achievement

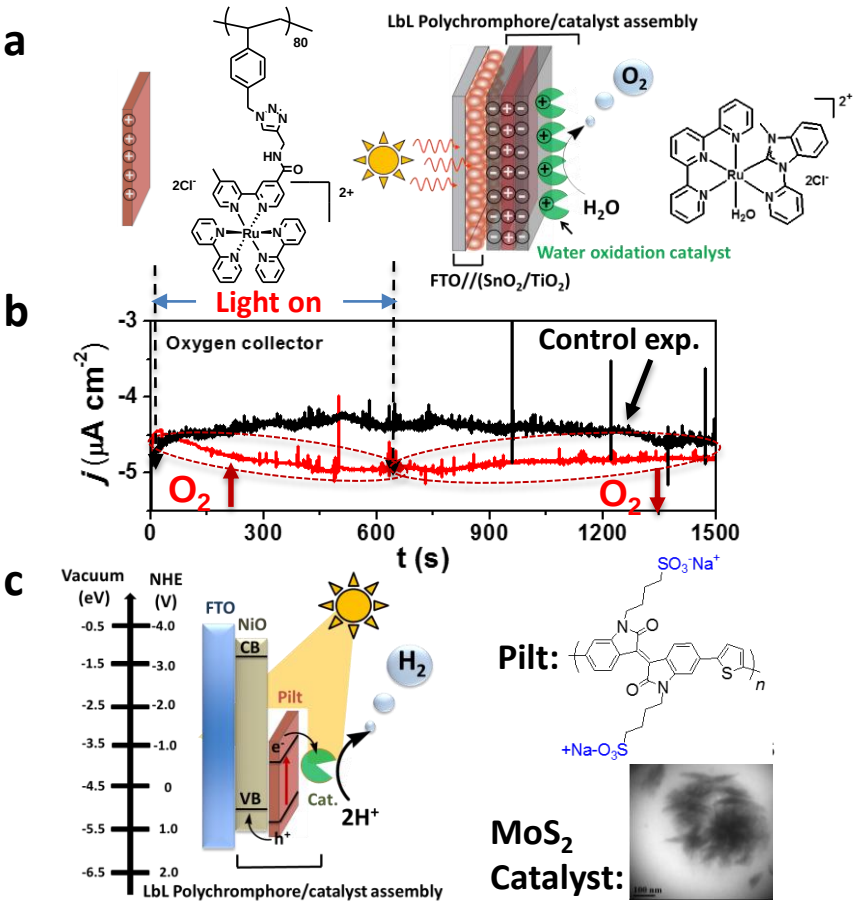
Polychromophore-catalyst multilayer assemblies have been fabricated by using the Layer-by-Layer (LbL) self-assembly approach. This is the first demonstration of the use of polyelectrolyte LbL to construct chromophore-catalyst assemblies for light-driven water splitting.

Significance and Impact

A new research path to develop chromophore–catalyst assemblies, in the absence of a surface covalent linkage to the metal oxide surface, using the self-assembled LbL approach for DSPEC applications.

Research Details

- LbL polystyrene-based polychromophore/ruthenium-based water oxidation catalyst assemblies enable production of O_2 by illumination of the photoanode in aqueous solution. Production of O_2 is confirmed by monitoring cathodic current at a collector–electrode.[1]
- The LbL approach easily extends to the construction of polyelectrolyte assemblies consisting of an anionic π-conjugated poly(isoindigo-co-thiophene) (Pilt) and a MoS_2 proton reduction catalyst for light-driven reduction at a photocathode.[2]



(a) Schematic illustration of light-driven water splitting processes in LbL/TiO_2 photoanode. (b) Current–time traces at an FTO collector electrode measured concurrently with the photoelectrochemical–time trace. (c) Energy diagram of light-driven water splitting processes in a photocathode.

Work was performed at University of Texas at San Antonio, University of North Carolina at Chapel Hill and Georgia Institute of Technology.

1. Leem, G.; Sherman, B. D.; Burnett, A. J.; Morseth, Z. A.; Wee, K.-R.; Papanikolas, J. M.; Meyer, T. J.; Schanze, K. S. ACS Energy Lett. **2016**, *1*, 339–343, DOI: 10.1021/acsenergylett.6b00171.
2. Leem, G.; Black, H. T., Zhao, Y., Burnett, A. J., Reynolds, J. R., Schanze, K. S., In preparation.

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