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## Metal oxide nanowires for sensing and conversion of light

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Efficient assembly techniques of nanowires into devices using bottom-up approaches are reported. Photodetectors for ultraviolet Tradiation are fabricated by bridging nanowires between electrodes and photoanodes for water splitting are demonstrated using vertically aligned nanowires on a film structure.

The photodetectors consist of thick layers of nanowires forming the electrodes and nanowires bridging the gap between the thick electrodes [1]. The bridged nanowires are the sensing elements of the devices. The device fabrication provides contamination-free surfaces of nanowires because no post treatment is needed after the nanowire synthesis and also substrate-independent properties because the bridged nanowires are not in contact with the substrate. The bridged nanowire devices allow for fast and sensitive photoresponses. Photoresponses with zinc oxide nanowires for UVA detection and beta gallium oxide nanowires for UVC, that is solar blind detection, are reported [2].

The photoanodes are made of vertically aligned nanowires on a conductive film. Zinc oxide nanowires are synthesized together with a ZnO film in a single chemical vapor deposition step. This nanowires-on-a-film structure enables efficient current collection through the underneath ZnO conducting film, thus realizing easy integration of the nanostructured photoanodes in photoelectrochemical cells. Anticorrosive property of the ZnO nanowires is obtained by the subsequent formation of ZnGa<sub>2</sub>O<sub>4</sub> shells onto the ZnO cores. The core-shell photoanode realizes stable water oxidation under solar light [3]. Further enhancement in visible solar light conversion of the core-shell photoanode will also be presented.

- [1] Y. B. Li, J.-J. Delaunay et al., Nanotechnology 20, 045501 (2009)
- [2] Y. B. Li, J.-J. Delaunay et al., Advanced Functional Materials 20, 3972 (2010)
- [3] M. Zhong, J.-J. Delaunay et al., Nanoscale 4, 1509 (2012).

## **Biography**

Jean-Jacques Delaunay is an Associate Professor at the School of Engineering, The University of Tokyo. He has worked for research institutions in the fields of nanotechnology and solar energy in France, Germany and Japan. He conducts research on the synthesis of nano-materials with controlled structures and functionalities for sensing and energy conversion. His current research projects include bridged nanowires to detect light, vertically aligned nanowires to split water, and metallic nano-hole arrays to detect volatile organic compounds.

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