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Biography

Xingwang Zhang received BEng degree in Environmental Engineering from the Shandong University in 2001, and Ph.D. degree from the College of Environmental & Resources, Zhejiang University in 1996. He is currently a professor in the College of Chemical and Biological Engineering, Zhejiang University. He has published more than 80 journal papers. His research interests cover mainly phoelectrochemisty, nanomaterials and environments.

Presentation Title: 3D Silicon Nanopillars Coated with Earth-Abundant Electrocatalysts for Enhanced Photoelectrochemical Hydrogen Production

Solar-driven photoelectrochemical (PEC) water splitting for hydrogen production promises to solve the impending energy and environmental crisis. The key to increase the efficiency of PEC hydrogen generation is developing high-performance catalysts and photocathodes. 3D p-type silicon (p-Si) arrays are promising architectures due to the high light harvesting and the large interfacial areas. We demonstrate its enhanced PEC performance with a photocurrent density of -37.5 mA/cm^2 at 0 V (vs. RHE) under simulated 100 mW/cm^2 (1 Sun) with an AM 1.5 G filter, which is the highest value reported for p-type Si photocathodes. The synergic effects of the excellent light harvesting of Si nanopillar (NP) array core and the good optical transparency , as well as excellent electrocatalytic activity of $NiCoSe_x$ shell boost the production and utilization of photogenerated electrons. The Faradaic efficiency of H_2 and O_2 on p-Si/$NiCoSe_x$ was approximately 100%, which confirmed that the photocurrent during PEC reaction was attributed to hydrogen generation. The completely enclosed core-shell structure isolated the Si NP from air and aqueous electrolyte and minimized the oxidation of silicon, leading to good stability. The design of p-Si/$NiCoSe_x$ core/shell NP arrays offers a new strategy for preparing highly efficient photoelectrochemical solar energy conversion devices.