Photoelectrochemical Water Splitting for Solar Hydrogen Production over Semiconductor Nanostructures

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Sunlight is a clean, renewable and abundant energy source on the earth. Its conversion to hydrogen has been considered an ideal solution to counter the depletion and environmental problems of fossil fuels. Photoelectrochemical water splitting is an ideal technology for the purpose, since H_2 could be produced directly from abundant and renewable water and solar light from the process [1,2]. The key to the technology is photoelectrodes of high efficiency, high stability, and low cost. In addition of the discovery of new materials, the structure and morphology of the known materials could be designed to enhance the performance of the photoelectrodes.

In this presentation, the concepts of materials design and their examples are proposed for efficient photoelectrodes of photoelectrochemical (PEC) cells for visible light water splitting. We discuss the material designs including: i) Nanoparticles electrodes to minimize the diffusion length of the minority carrier, ii) p-n heterojunction photoanodes for effective electron-hole separation, iii) electron highway to facilitate interparticle electron transfer, iv) metal doping to improve conductivity of the semiconductor, and v) one-dimensional nanomaterials for vectoral electron transfer.

High efficiency has been demonstrated for all these examples due to efficient electron-hole separation. Modern material processing techniques have been explored to materialize these concepts [3-6].

References

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