Author: Nikolay Kornienko, Peidong Yang

Title:

"Synthesis and photoelectrochemistry of Indium Phosphide nanowires"

Solution Phase Growth and Photoelectrochemical Energy Conversion of Indium Phosphide Nanowires

Abstract:

"Indium Phosphide is an attractive material for use in photoelectrochemical (PEC) water splitting. The 1.35 eV direct band gap of Indium Phosphide (InP) allows it to efficiently utilize a large part of the solar spectrum while its conduction band edge position makes it suitable for use as a photocathode. However, the low earth abundance of Indium makes the use of single crystal InP wafers for PEC expensive and impractical. Nano-materials have a much higher surface to volume ratio than bulk materials and, as a result, large densities of reactive sites that allows for the use of much less material when constructing photoelectrodes as well as a greater ease in matching surface catalytic turnover frequency to the incident solar photon flux. Indium Phosphide nanowires (NW's) were synthesized via a novel solution phase self-seeded solution-liquid-solid (SLS) method. The InP NW's were then used to fabricate photocathodes for photoelectrochemical water splitting, using only ~1/3000 the amount of material of a bulk InP wafer. PEC performance was enhanced with in situ p-type doping with Zinc and through variation of the NW diameter. The surfactant free synthesis offers scalability not available with vapor phase growth methods such as vapor liquid solid (VLS) growth or metallo-organic chemical vapor deposition (MOCVD) and the nano-structured morphology of the p-InP photocathodes allows for the use of minimum quantities of photocatalyst material for PEC."