Photo-electro Catalytic Water Splitting over Pure and Modified Iron Oxide Thin Films

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Abstract

Photo-catalytic water splitting offers the possibility of creating a clean renewable energy source by synthesizing H_2 from water and sunlight, therefore reducing society usage of fossil fuels. However it is a great challenge to synthesize a material with the right electronic and chemical properties for efficiently driving the process, while being sustainable in terms of both stability and costs.

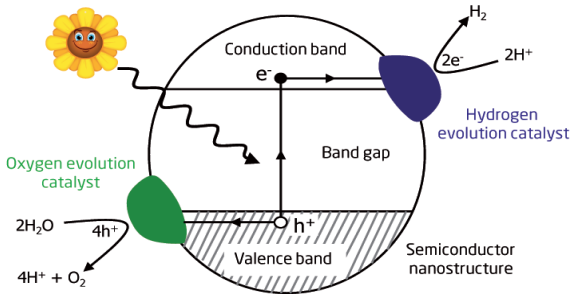

Figure 1: A semiconductor absorbing a photon, thereby enabling photo-catalysis. Illustration: Søren Dahl

The semiconductor properties of iron oxide enables it to split water when submerged in an aqueous solution while irradiated by sunlight. Unfortunately it also needs an external applied voltage, which reduces the overall efficiency of the system. Iron Oxide is stable in non-acidic aqueous solutions and it is both abundant and cheap making it a great candidate for world wide application if its efficiency could be increased.

Through various surface treatments and modification of iron oxide thin film compositions, research previously has shown, that the properties of this material can be improved significantly.

This thesis focusses on improving the bulk properties of the material by adding a dopant and improving the surface properties by adding catalysts.
The results have so far shown, that doping the thin films with titanium has improved some parameters including the saturated photocurrent. The surface treatments and tests has likewise yielded successful results in reducing losses occurring at the water to iron oxide interface.