From Light to Molecules: Solar Energy Conversion for Hydrogen Production

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Converting solar energy into storable chemical fuels is a highly challenging goal for green energy generation.[1] Photoelectrochemical (PEC) water splitting on semiconductor devices to produce hydrogen is one such an environmentally friendly solution. Water splitting encompasses the hydrogen evolution reaction and the oxygen evolution reaction. The first investigated photoelectrode was a TiO_2 photoanode, but despite its stability under the operating conditions, the large band gap of 3.2 eV limits its absorption of visible light.

Therefore, it is indispensable to develop a stable semiconducting material with a narrower band gap to utilize visible light capably, which represents almost half of the available solar spectrum. This has triggered intense research into semiconductor oxides for photoanodes with narrow electronic band gaps and structural stability. In addition to oxide semiconductors, nitrogen-based materials have emerged recently as prospective photoanodes (Figure 1). For instance, core-shell $SrTaO_2N$ nanowires containing functional overlayers show synergetic hole extraction from the oxynitride core to the catalyst surface.[2] Another representative of nitrogen-based materials are metal carbodiimides MNCN that consist of a transition metal and a NCN^{2-} anion, which can be present in the form of a carbodiimide or cyanamide.[3]

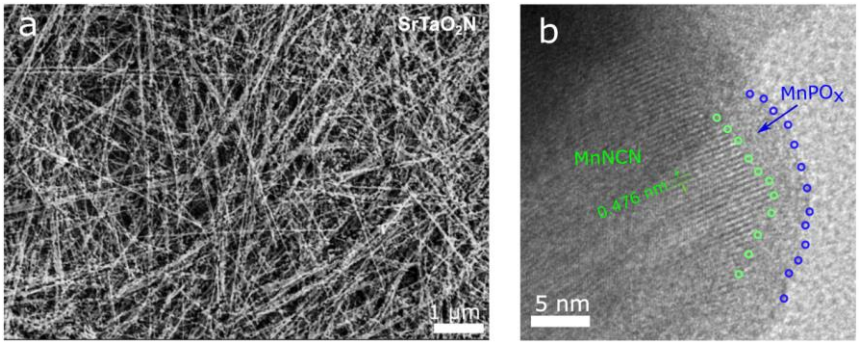

Figure 1. (a) Top-view on $SrTaO_2N$ nanowire photoanode.[2] (b) TEM image of a MnNCN-based electrocatalyst after electrochemical activation.[3a]

References:

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