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Solar assisted water splitting in a photoelectrochemical cell

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One of the important practical issues in solar energy harvesting is energy storage as solar radiation varies hourly and seasonally. The common practice is to store energy in batteries. An alternative possibility is to store them in the form chemicals from which the energy could be regained subsequently. This is called solar fuels and there is keen interest in them now. Hydrogen is a simple form of chemical energy which could be readily converted to thermal energy. Obtaining hydrogen by electrolytic splitting of water is an established process. However, this uses significant electrical energy. In solar fuel production we intend to use photons to aid the water splitting in an electrochemical device to reduce the energy requirement for splitting water. The photoelectrochemical (PEC) cell is one such device that is being examined for this purpose. This work deals with the development of large anodes of active area about 25 cm^2 for water splitting in a PEC cell. Oxides responsive to visible light such as Fe_2O_3, $BiVO_4$ were investigated as photoactive anodes. Such investigations have previously concentrated on small area anodes such as 2 to 5 cm^2. In this work we designed and built a large PEC cell to take anodes of typical size 5x5 cm. We produced and tested $BiVO_4$, samples for their performance. The practical problems encountered in translating small scale anodes to large areas will be highlighted and discusses. Increasing the illumination area generally resulted in loss of photo current density. This loss is caused by several factors which must be understood to take corrective actions to improve the current. The stability and degradation mechanism of $BiVO_4$ is of particular interest as it is known to be less stable than Fe_2O_3. The mechanistic insights into the degradation will be analyzed with experimental data as direct evidence.

Biography

Thirumany Sritharan is a Professor at the School of Materials Science and Engineering, NTU Singapore. His expertise is in multiferroic materials, thin films and solar energy harvesting. He is currently the main PI in NTU for the multi-million $ CREATE program between NTU-Singapore, University of California – Berkeley and NUS, Singapore. This program is fully funded by the National Research Foundation of Singapore under their CREATE umbrella funding program. It is on the topic of Sustainable Energy and has a total of about 60 researchers from both Singapore and Berkeley. Prior to this, he worked on multiferroic materials with special attention $BiFeO_3$ epitaxial thin films and also on various thin film and interfacial problems in microelectronic circuits. He obtained his PhD from The University of Sheffield, UK and worked at The University of Melbourne and Comalco Research Centre, Melbourne before joining NTU Singapore.

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