Synergistic crystal facet engineering and self-doping of $BiVO_4$ photoanode for enhanced photoelectrochemical water splitting

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$BiVO_4$ films with (110) and (040) facets contacted with fluorine doped SnO_2 (FTO) glass substrates (denoted as BVO-(110) and BVO-(040), respectively) are tailored by a seed-assisted hydrothermal method. BVO-(110) exhibits much higher photocatalytic activity than BVO-(040). The photocurrent density of BVO-(110) is significantly enhanced by electrochemical treatment, reaching 2.5 mA cm^{-2} at 1.23 V versus revisable hydrogen electrode (RHE) under AM 1.5 G illumination, which is approximately 5 folds higher than that of electrochemical treated BVO-(040). With cobalt borate (CoBi) as cocatalyst, electrochemical treated BVO-(110) exhibits an applied bias photon-to-current efficiency (ABPE) of 1.1% at low bias (0.7 V versus RHE). Systematic studies reveal that crystal facet engineering synergistically boost charge separation and transfer efficiencies, resulting in enhanced photocurrent densities. The new findings demonstrated in this work provide a promising approach for the development of efficient photoelectrodes for water splitting.

Biographical Statement of speaker:

Songcan Wang is a current PhD student under the supervision of Prof. Lianzhou Wang at School of Chemical Engineering, The University of Queensland (UQ), Australia. His research interests are mainly focused on the design and development of high performance photoanodes for photoelectrochemical energy storage and conversion.