2022「中技社科技獎學金」

2022 CTCI Foundation Science and Technology Scholarship

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Living Grant for International Graduate Students

Novel Nanocomposites for Photo-(Electro-) Chemical Water Splitting and CO_2 Reduction

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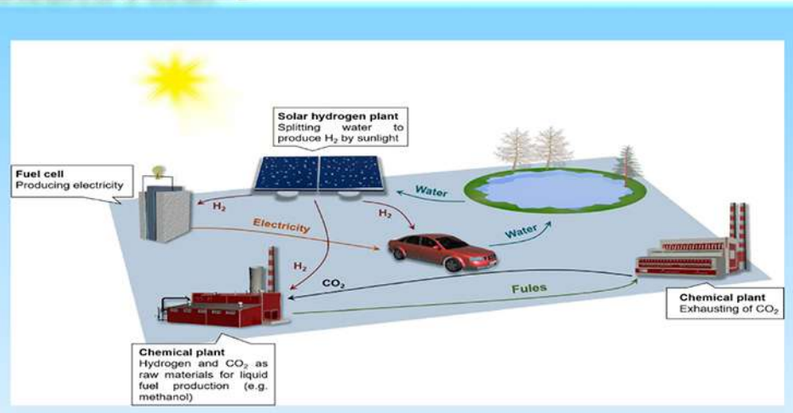
Introduction

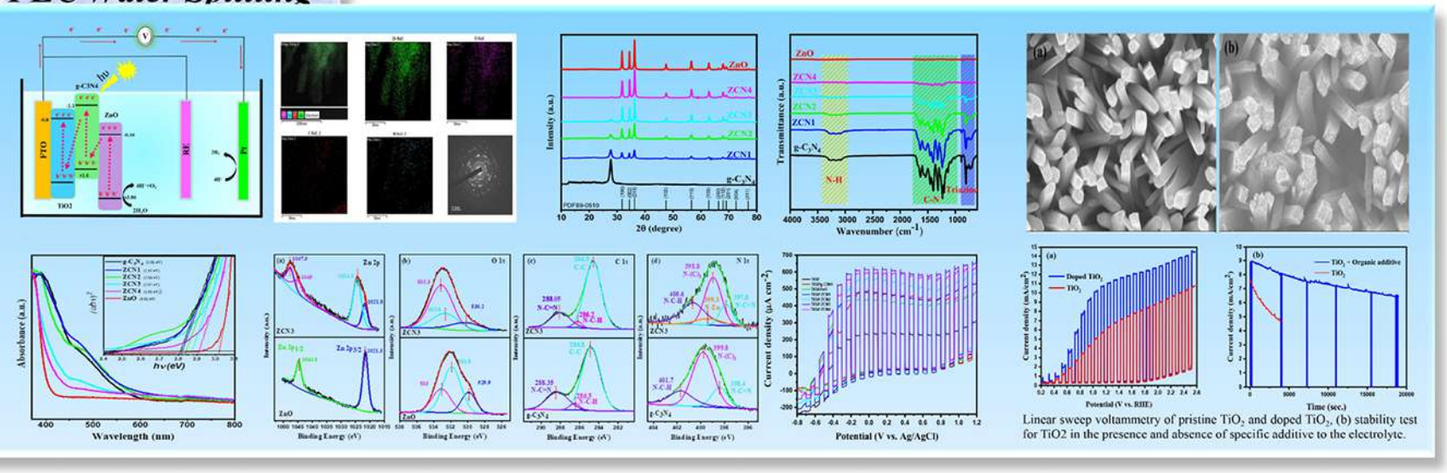
Photo-(electro-)chemical (PEC) water splitting and CO_2 reduction have emerged as promising routes for the production of hydrogen and value-added compounds, respectively. These strategies has been potential tools to alleviate the greenhouse effect and climate changes caused mostly via CO_2 emissions. These strategies mainly rely on the photo-(electro-) catalyst used to conduct these catalytic reactions. Thus, a wide range of composites have been investigated for these goals. TiO_2-based phototcatalyts have been fabricated and tested towards PEC water splitting. The as-prepared composites showed remarkable enhanced activity, compared to the pristine components. Concerning EC water splitting, some durable binder-free bi-functional electrocatalysts that have been showing promising performance, have been synthesized. These composites are chalcogenide-based electrocatalysts. Also, copper sulfide-based composites have been fabricated. The preliminary results of these composites indicate to the electrocatalytic reduction of CO_2 to formate.

Research Focus



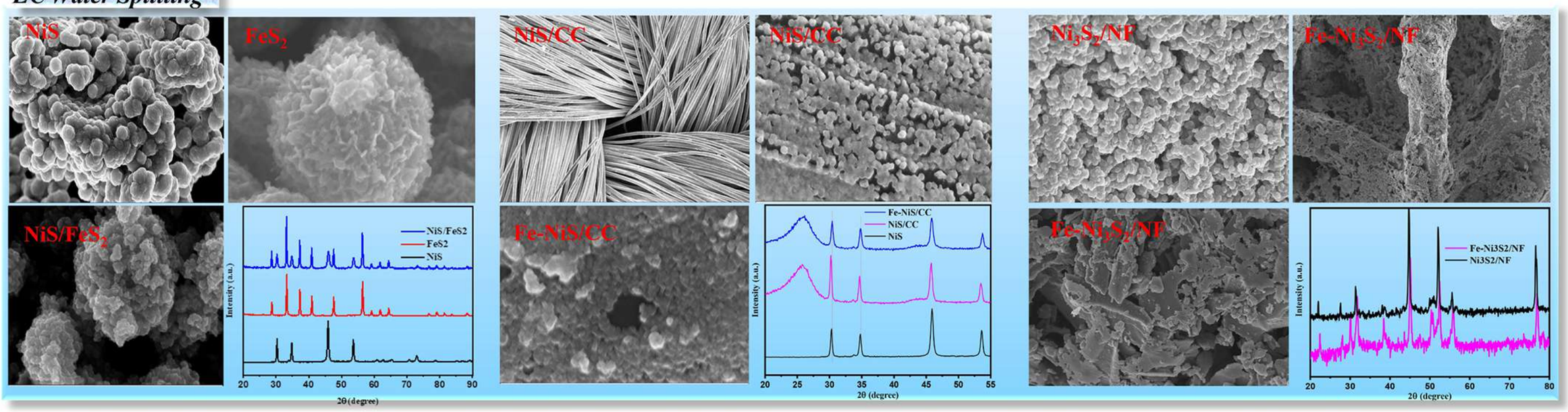
Fuel cycle based on photo-(electro-) catalytic water splitting & CO_2 reduction (Walter, Warren et al. 2010).

PEC Water Splitting

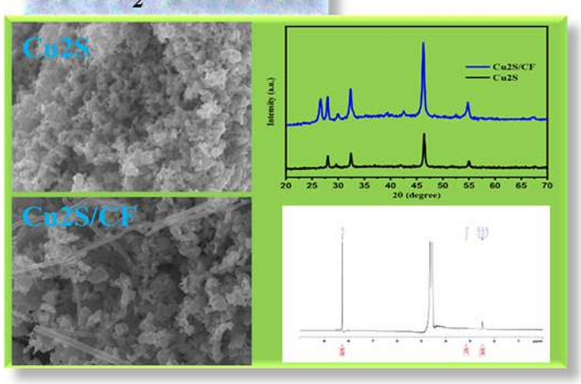


Linear sweep voltammetry of pristine TiO_2 and doped TiO_2, (b) stability test for TiO2 in the presence and absence of specific additive to the electrolyte.

EC Water Splitting



EC CO_2 Reduction



Conclusion

Regarding Phototelectrocatalytic water splitting, we are developing novel strategy for the fabrication of three component-based photocatalysts to obtain Z-scheme heterostructures. We believe that the as-prepared composites can enhance the photocatalytic activity via promoting the separation and transfer of the photo-generated charge carries. Also, some chalcogenide electrocatalyst have been tested toward EC water splitting. The performance of these composites nominates it to replace some of the precious metals applied for H_2 production. Moreover, copper sulphide has been applied for EC CO_2 reduction. The obtained results shows that this electrocatalyst has high selectivity towards formate production.

Acknowledgment

財團法人中技社 CTCI FOUNDATION