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Facile Synthesis and Characterization of BiV04 and CuBi204 for self-sustained photoelectrochemical water splitting devices

poster abstract

Facile Synthesis and Characterization of $BiVO_4$ and $CuBi_2O_4$ for self-sustained photoelectrochemical water splitting devices

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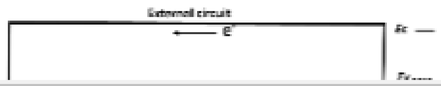
A place of innovative minds

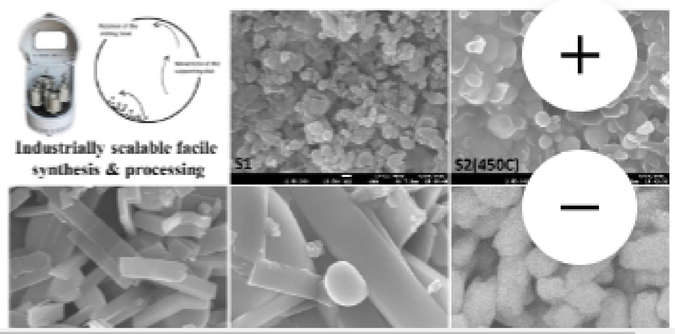
BACKGROUND

- Photoelectrochemical (PEC) devices for sunlight harvesting and storage.
- Ecofriendly Bi-based photoelectrode materials such as $BiVO_4$(BVO) and $CuBi_2O_4$ (CBO) for attaining high solar-to-hydrogen (STH) efficiency[1].
- BVO (μ_e~10^{-2} $cm^2/V.s$; L_h~100 nm)[2] : Suitable band alignment with n-type ZnO electrodes needed.

Metal oxide photoelectrodes for self-sustained PEC device[1]



BVO synthesis with tunable morphology, structure, and bandgap



Q&A

RY **Rowena Yew** 3 months ago

Hi, is the BVO a continuous layer on top of the ZnO NRs or coated over each ZnO NR? Thanks.

1

SF **Syed Farid Uddin Farhad** 3 months ago

Hello, it is thin conformal coating of BVO atop the ZnO NRs.

0

Ask a question

P.T.O. for poster details

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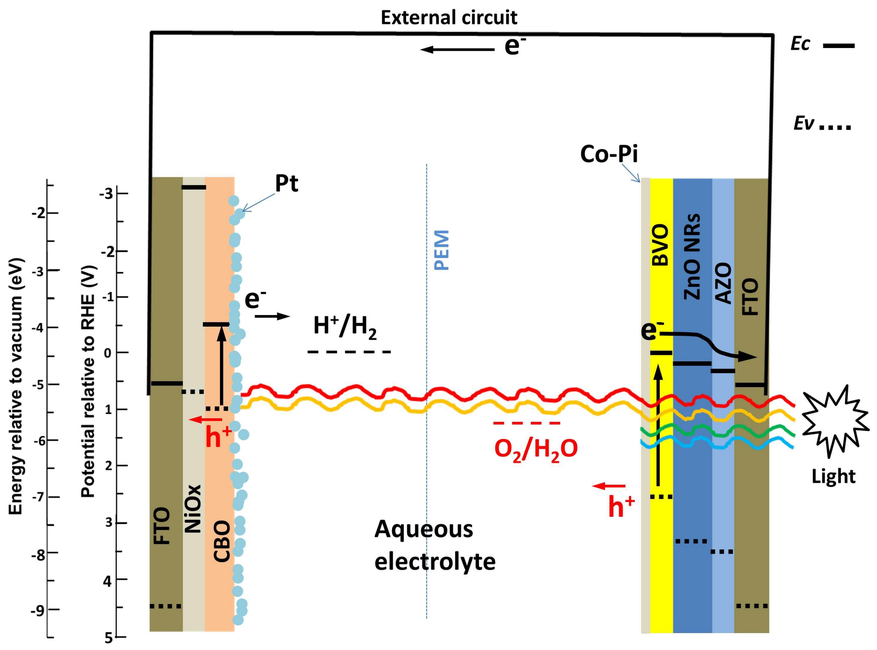
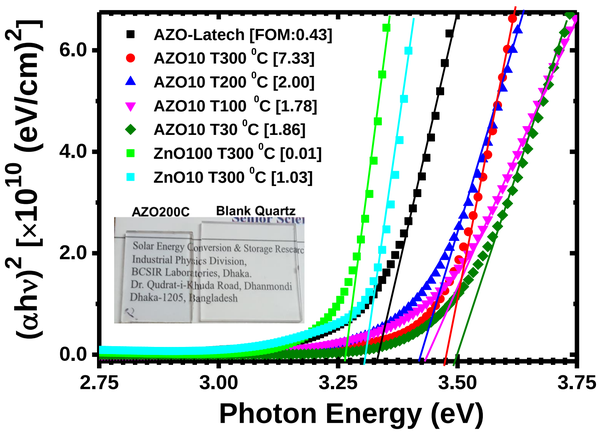


FTO: Fluorine-doped Tin Oxide
AZO: Al-doped ZnO electrode
ZnO NRs: ZnO Nanorod arrays
Co-Pi: cobalt-phosphate co-catalyst
PEM:Proton exchange membrane (e.g., Nafion)

ZnO layers with tunable features for BVO photoanode

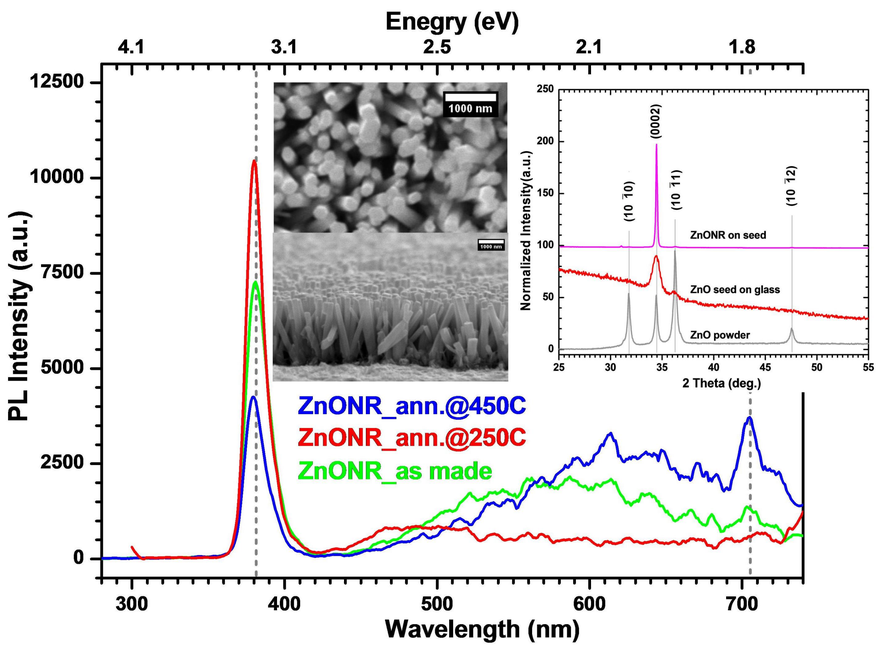


➢ Highly transparent and conducting pure and Al-doped ZnO electron conducting layers with tunable optical bandgap[1].

➢ Appreciable figure of merit (FOM) compared to commercial AZO electrode[1].

➢Hydrothermally grown *c*-axis oriented ZnO NRs[1,3]

➢Defect-free ZnO NRs[3] are desirable for BVO photoanode



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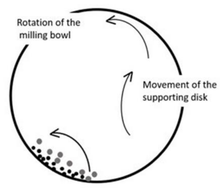
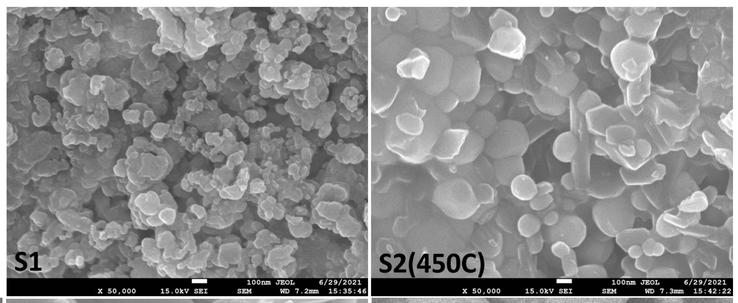
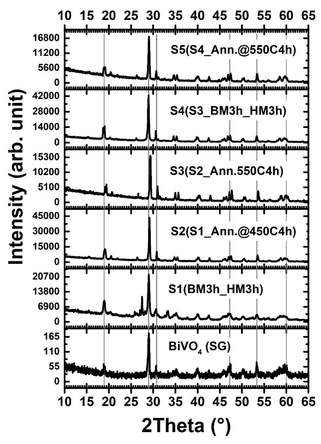
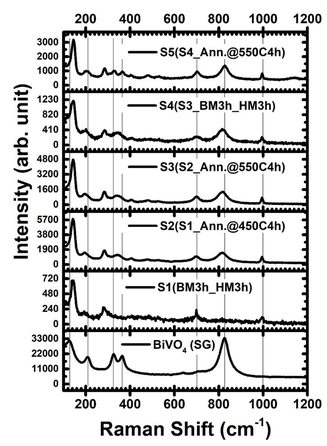


Industrially scalable facile synthesis & processing

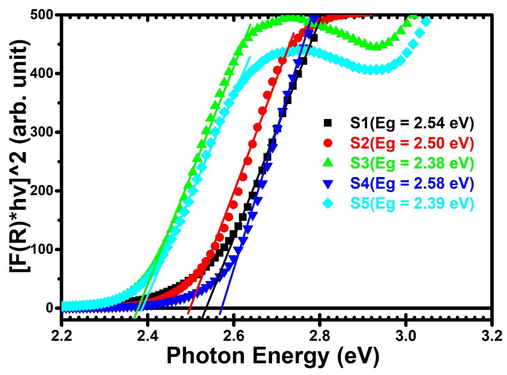


Monoclinic Scheelite BVO [(XRD: 2Θ~35 deg.) & Raman shift~815 cm^{-1})][4]

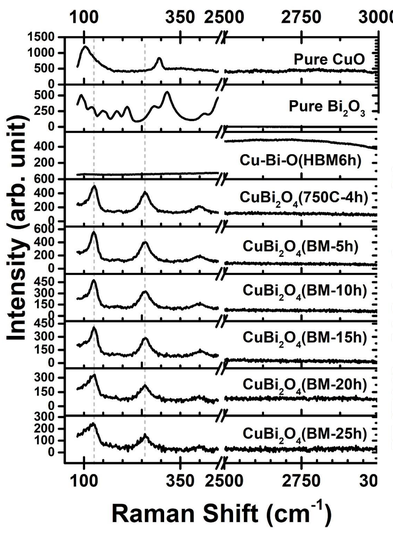




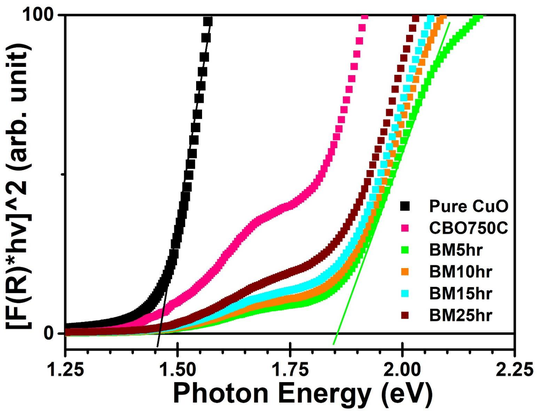
Bandgap from Diffuse Reflection



CBO synthesis with phase purity and tunable bandgap



➢Sintering of $CuO+Bi_2O_3$ powder @750 ^{0}C for 4 h produces phase pure CBO



➢ Size reduction of CBO grains (Ball Mill duration: 5 – 25 h); Band gap variation.

CONCLUSIONS

- ❑ Textured and tunable optoelectronic ZnO electrodes may offer suitable transport pathways for BVO photoanode.
- ❑ Ball mill derived solid-state reactions could be used for facile synthesising of BVO materials with tunable features
- ❑ Phase pure CBO materials with tunable bandgap could be synthesised by varying milling duration and processing conditions.

REFERENCES

(1) S.F.U. Farhad, Intl. Conference on S&T, March 11- 13, 2021.
(2) J.H. Kim and J.S. Lee, *Adv. Mater, 2019, 1806938.*
(3) S.F.U. Farhad *et al., MRS Advances, 4(16), 921-928,* 2019.
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