

From Heterojunction Design to Real-Water Performance: $\text{Bi}_2\text{WO}_6@WS_2$ -PVDF-HFP Sonophotocatalytic Membranes

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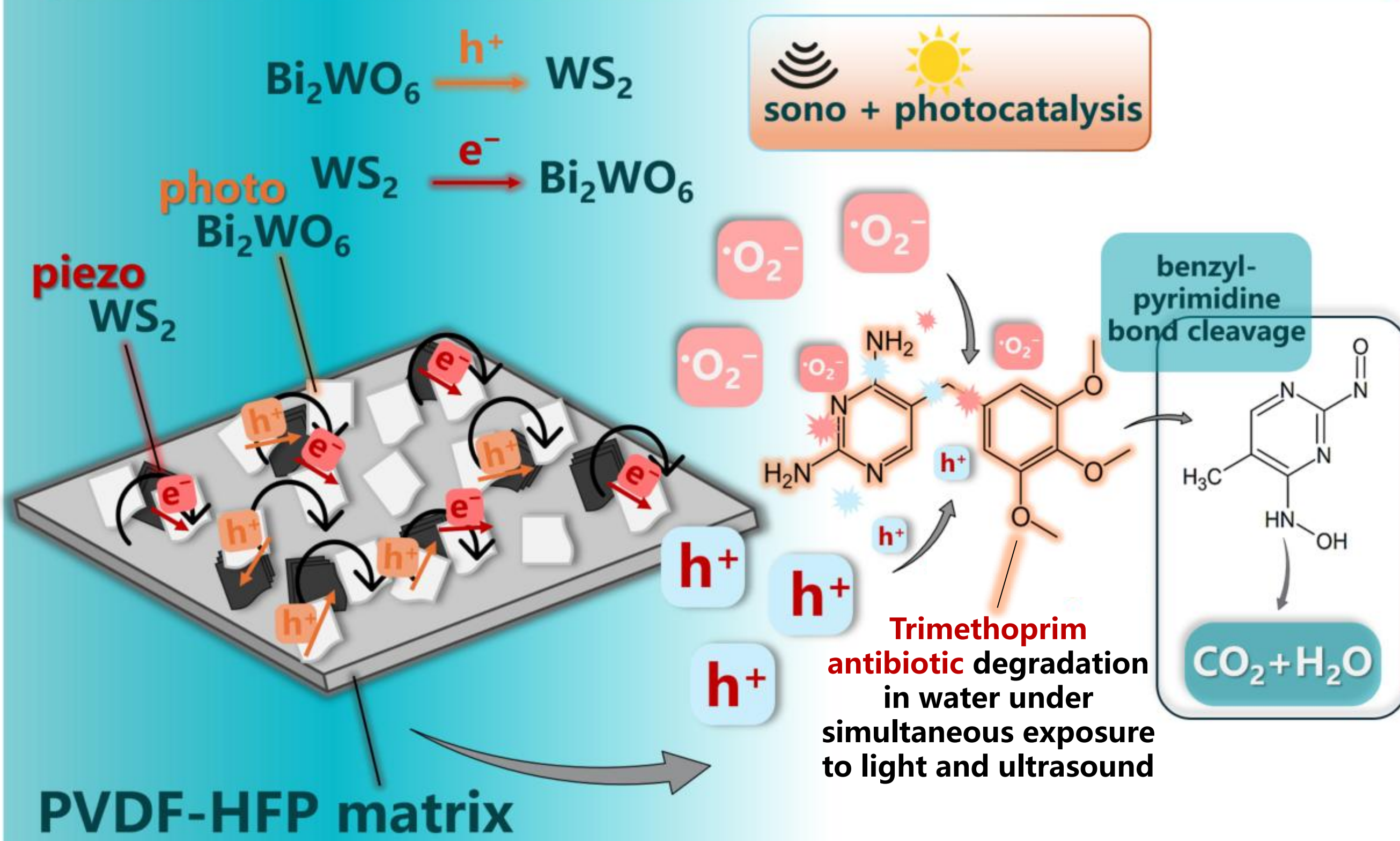
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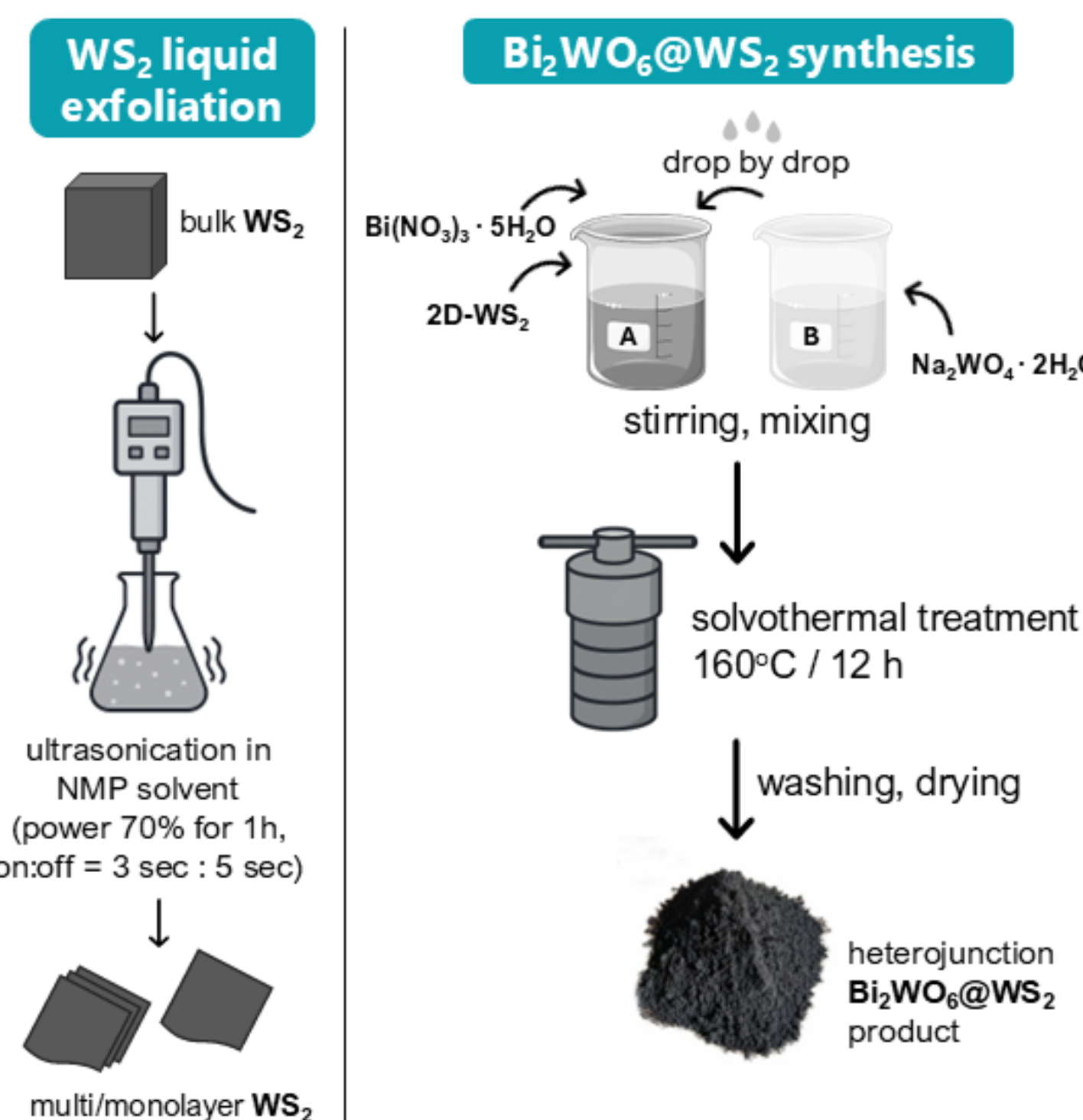
INTRODUCTION & AIM

Synergistic charge transfer in $\text{Bi}_2\text{WO}_6@WS_2$ S-scheme system



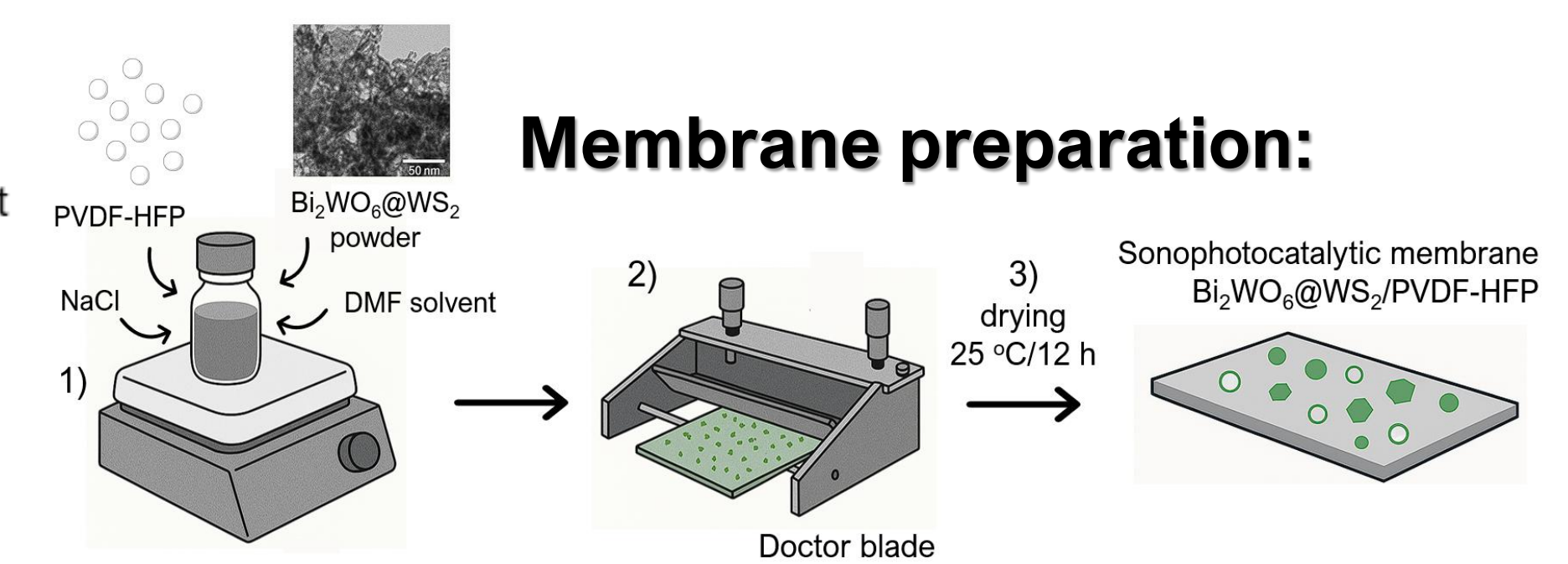
METHOD

Material synthesis:



A simple method for producing effective catalysts for water remediation

Membrane preparation:



RESULTS & DISCUSSION

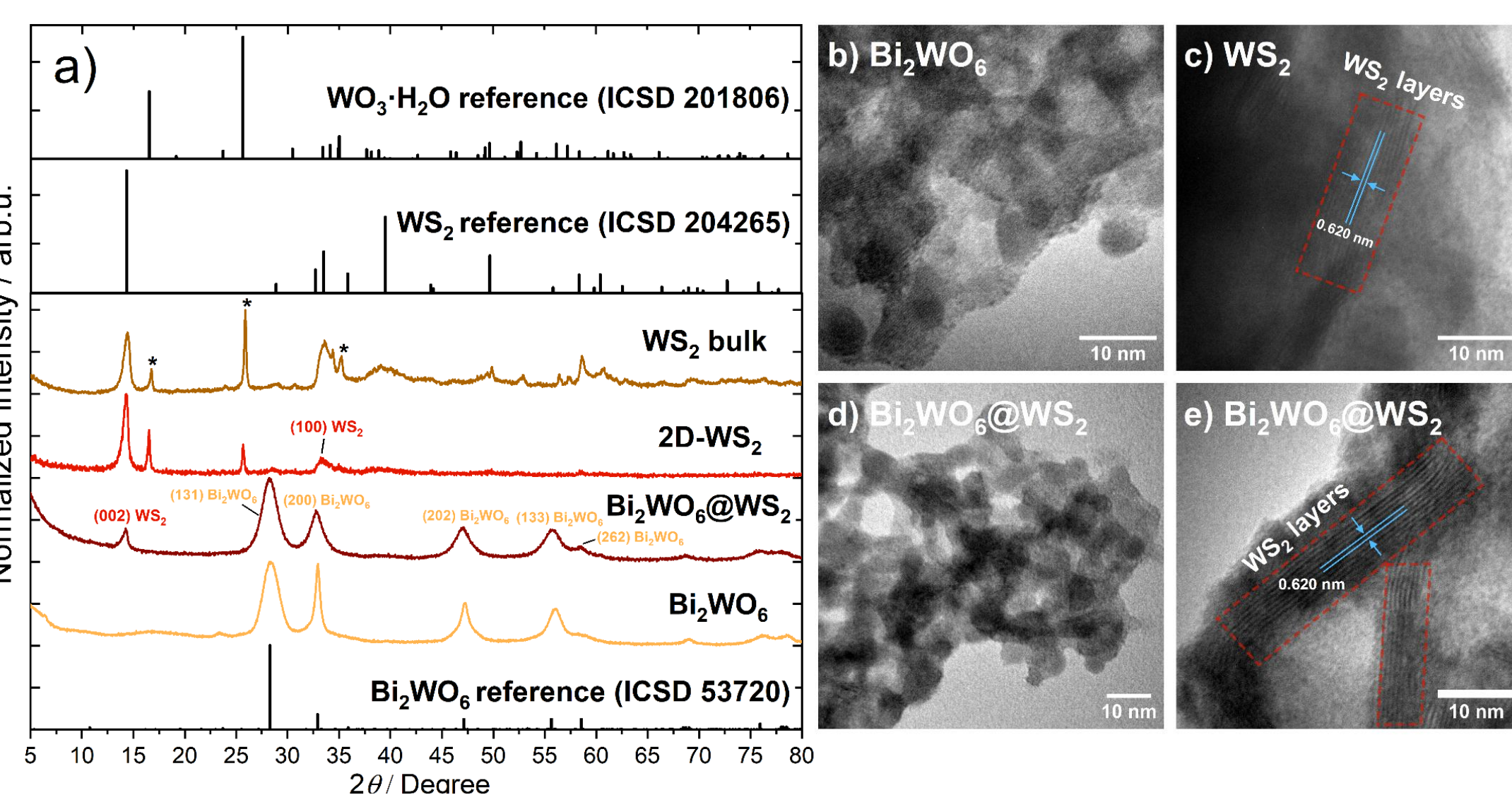


Fig. 1. (a) XRD patterns (b-e) TEM images of Bi_2WO_6 , WS_2 and $\text{Bi}_2\text{WO}_6@WS_2$ powders.

$\text{Bi}_2\text{WO}_6@WS_2$ heterojunction with strong interphase interactions and a modified electronic structure was synthesized, which contributes to improved catalytic properties.

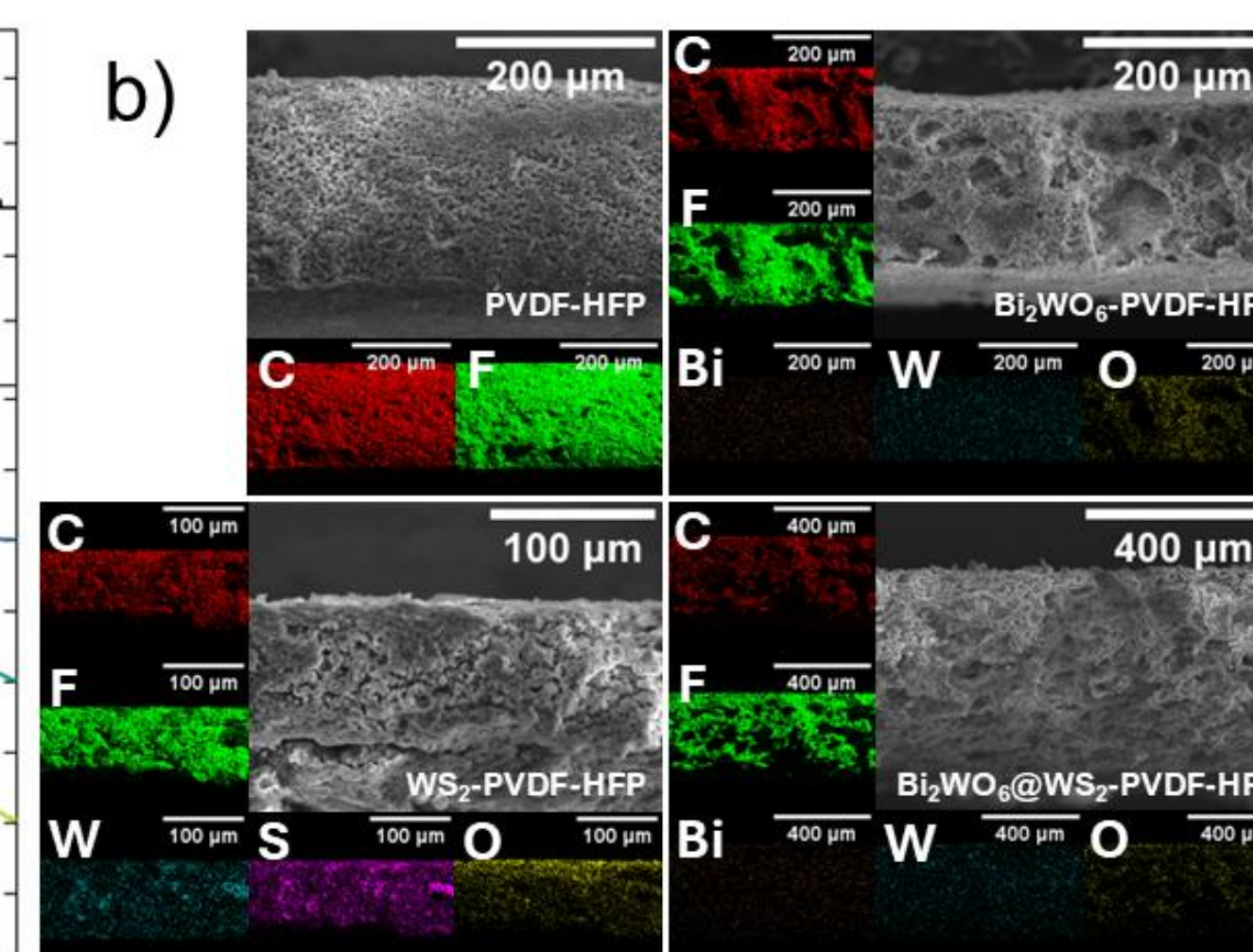
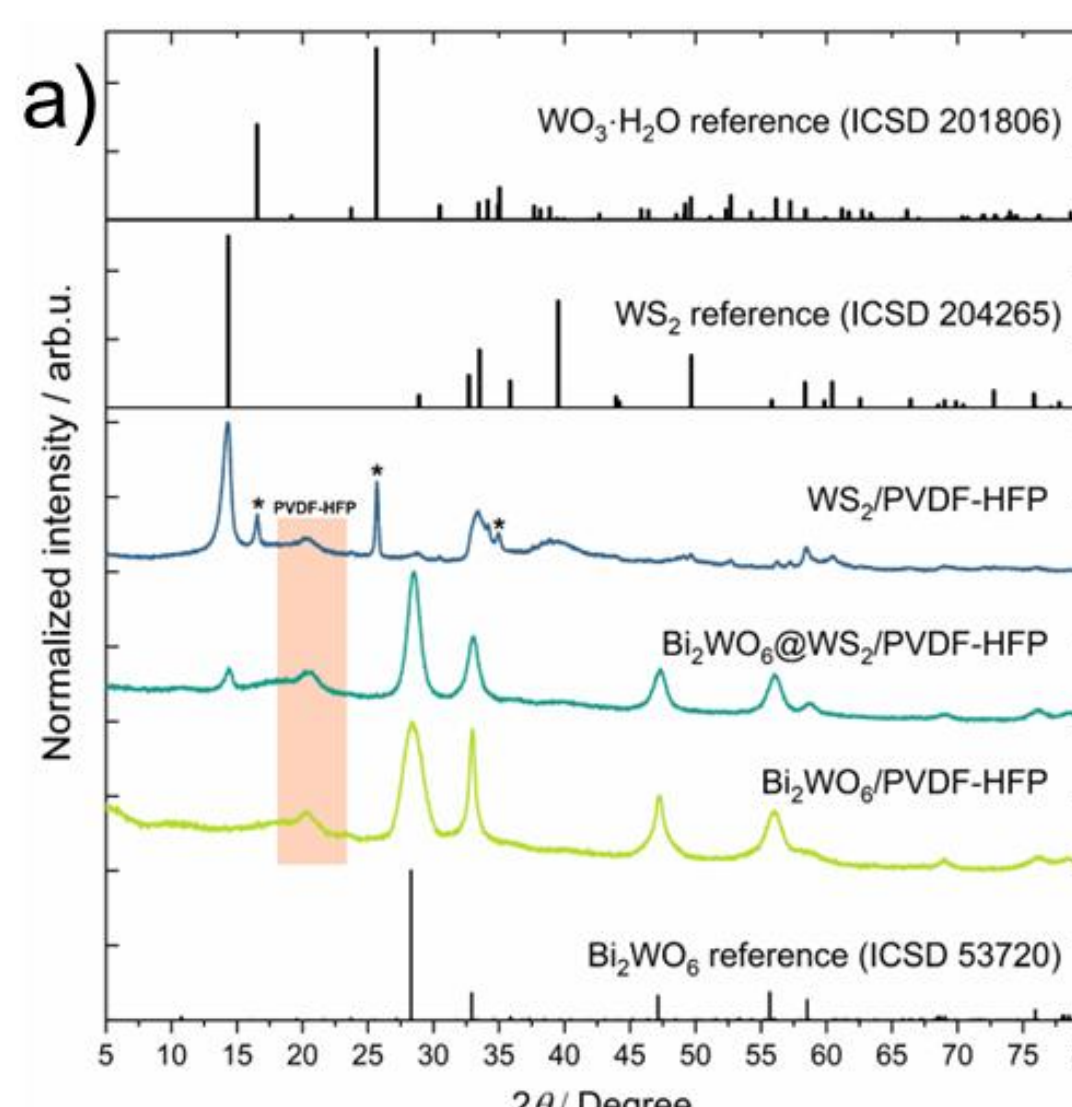


Fig. 2. (a) XRD patterns (b) SEM with EDX mapping of Bi_2WO_6 , WS_2 and $\text{Bi}_2\text{WO}_6@WS_2$ -PVDF-HFP based films.

PVDF-HFP composite films effectively incorporate Bi_2WO_6 and WS_2 without structural changes, exhibiting increased porosity and a uniform catalyst distribution that enhances performance.

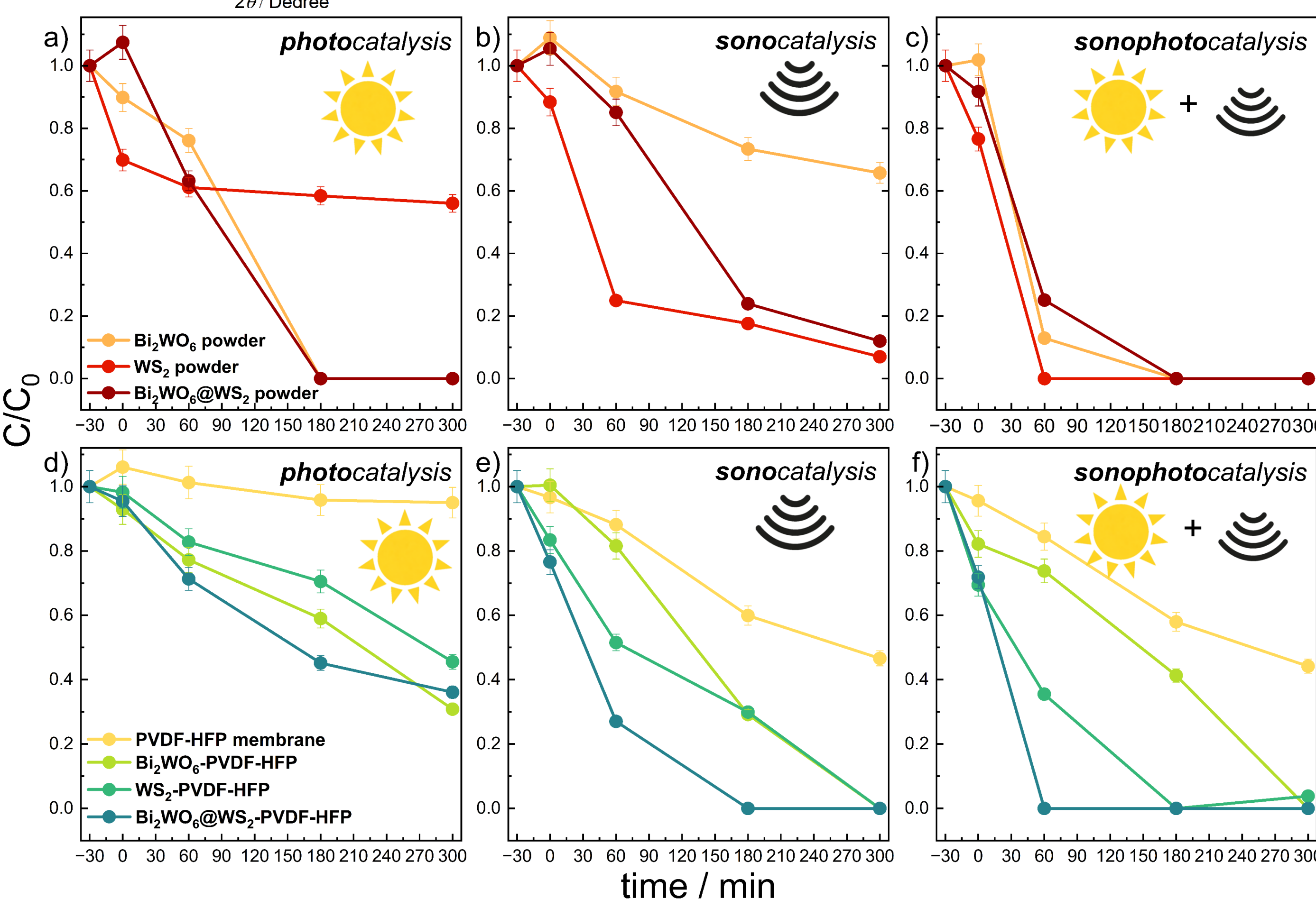


Fig. 3. TMP photocatalytic (a and d), sonocatalytic (b and e), sonophotocatalytic (c and f) degradation using powders (a-c) and films (d-f) of Bi_2WO_6 , WS_2 and $\text{Bi}_2\text{WO}_6@WS_2$.

S-scheme heterojunction

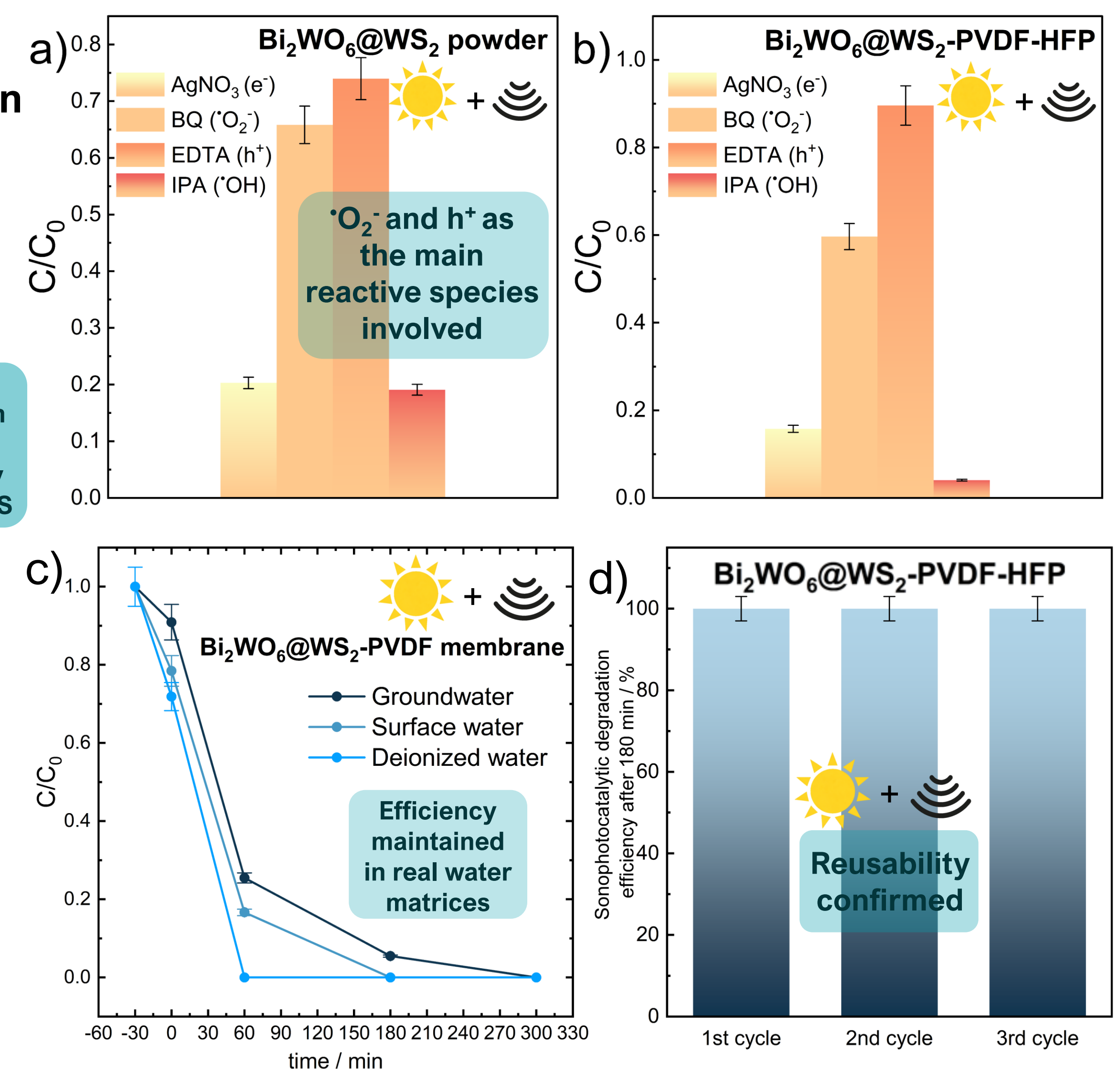
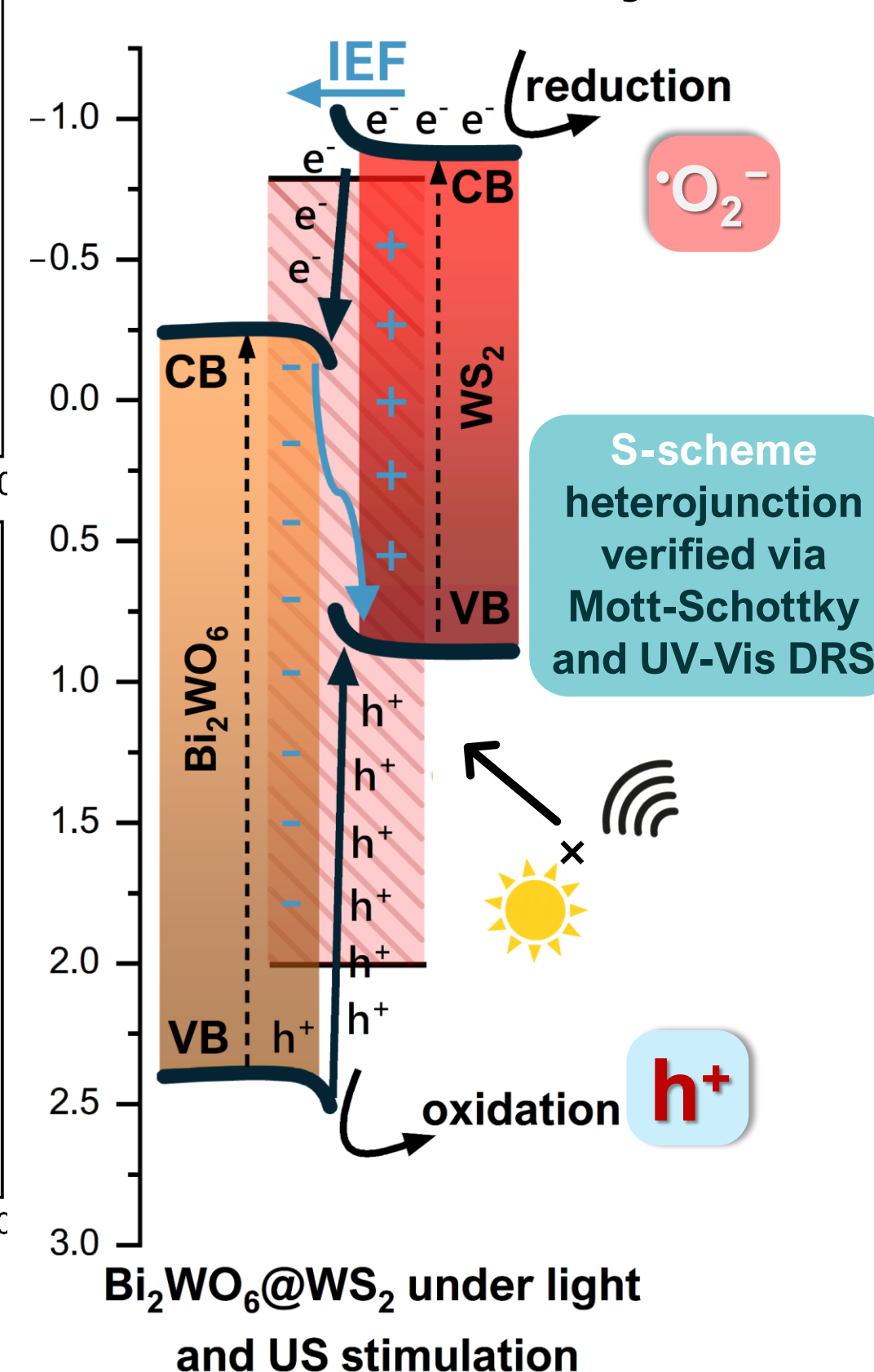


Fig. 4. Radical scavenging tests (a,b), studies on sonophotocatalytic degradation in real aqueous matrices (c), and studies on reusability (d).

CONCLUSIONS

- High efficiency:** $\text{Bi}_2\text{WO}_6@WS_2$ -PVDF-HFP completely degrades TMP when light and ultrasound are combined, outperforming individual components.
- Stability and reproducibility:** The film retains full activity over multiple cycles of use.
- Mechanism of action:** Strong interphase interaction and the S-scheme facilitate charge separation and the generation of reactive oxygen species.
- Environmental safety:** TMP degradation does not lead to the accumulation of toxic intermediate products.
- Scalability and versatility:** Effective in surface and groundwater, suitable for practical applications in water treatment.

FUTURE WORK/ REFERENCES/ACKNOWLEDGMENT

- Testing of larger systems and continuous operation under practical conditions.
- Evaluation of efficacy against other pharmaceuticals and contaminants in water.
 - Analysis of film stability and long-term degradation pathways.

Czekanowska, D., Salazar, H., Sáiz, J., Šarakovskis, A., Antuzevics, A., Lanceros-Mendez, S., Kholkin, A., & Głuchowski, P. (2026). Interfacially coupled $\text{Bi}_2\text{WO}_6@WS_2$ -PVDF-HFP based film for sonophotocatalytic trimethoprim removal: From material engineering to surface- and groundwater applications, *Chemical Engineering Journal* – [under review](#)



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