

Synthesis route matters: Interrogating the structural, morphological, optical, surface, photoelectrochemical and photocatalytic properties of lanthanum ferrite perovskite

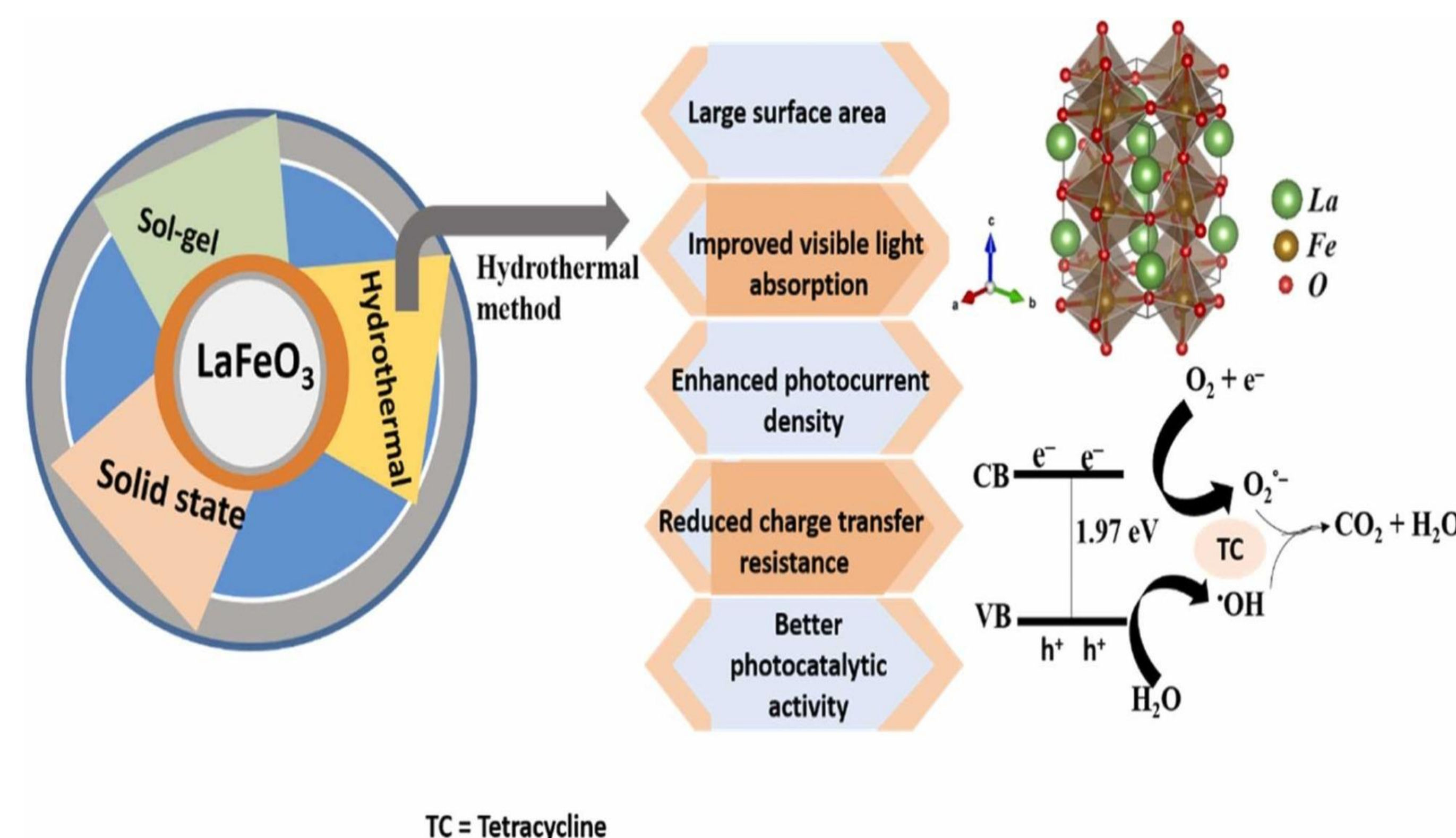
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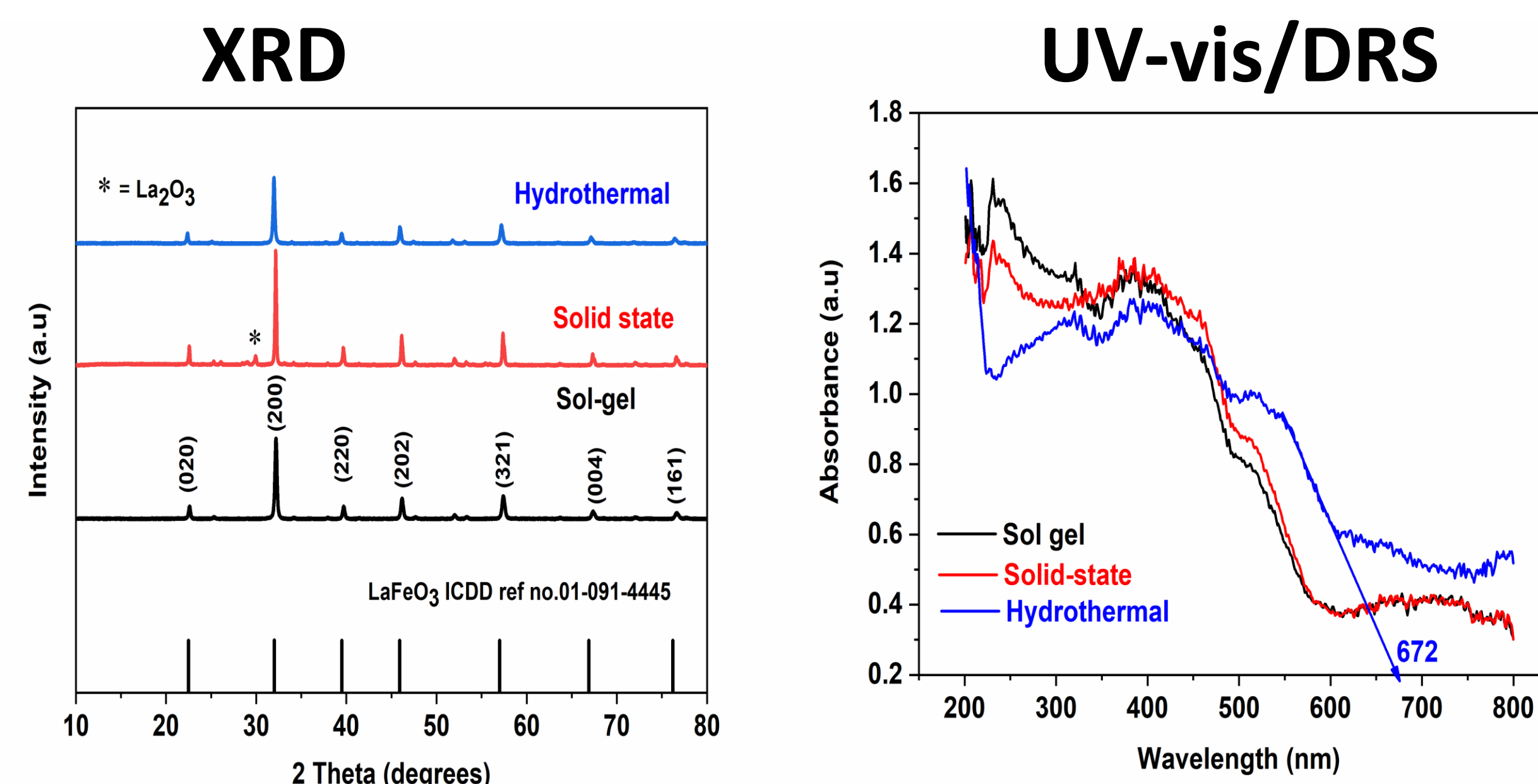
Introduction

Lanthanum ferrite (LaFeO_3) is a multifunctional perovskite oxide with antiferromagnetic and ferroelectric properties, making it suitable for diverse applications. Its catalytic performance is linked to its band structure, morphology, and defect chemistry which are influenced by the synthesis route. Oxygen vacancies and structural distortions are evident by synthesis method and so affects material's properties. This study investigates how three synthesis methods:- sol-gel, solid-state, and hydrothermal affect LaFeO_3 's structural, optical, surface, and photocatalytic properties. While solid state synthesis is industrially favored, hydrothermal and sol-gel methods yield materials with higher surface area and porosity, improving photocatalytic degradation of tetracycline, a persistent pollutant. To date, no comparative study has evaluated LaFeO_3 's photocatalytic performance across these synthesis routes, thus making this work a novel contribution.

Methodology



Results



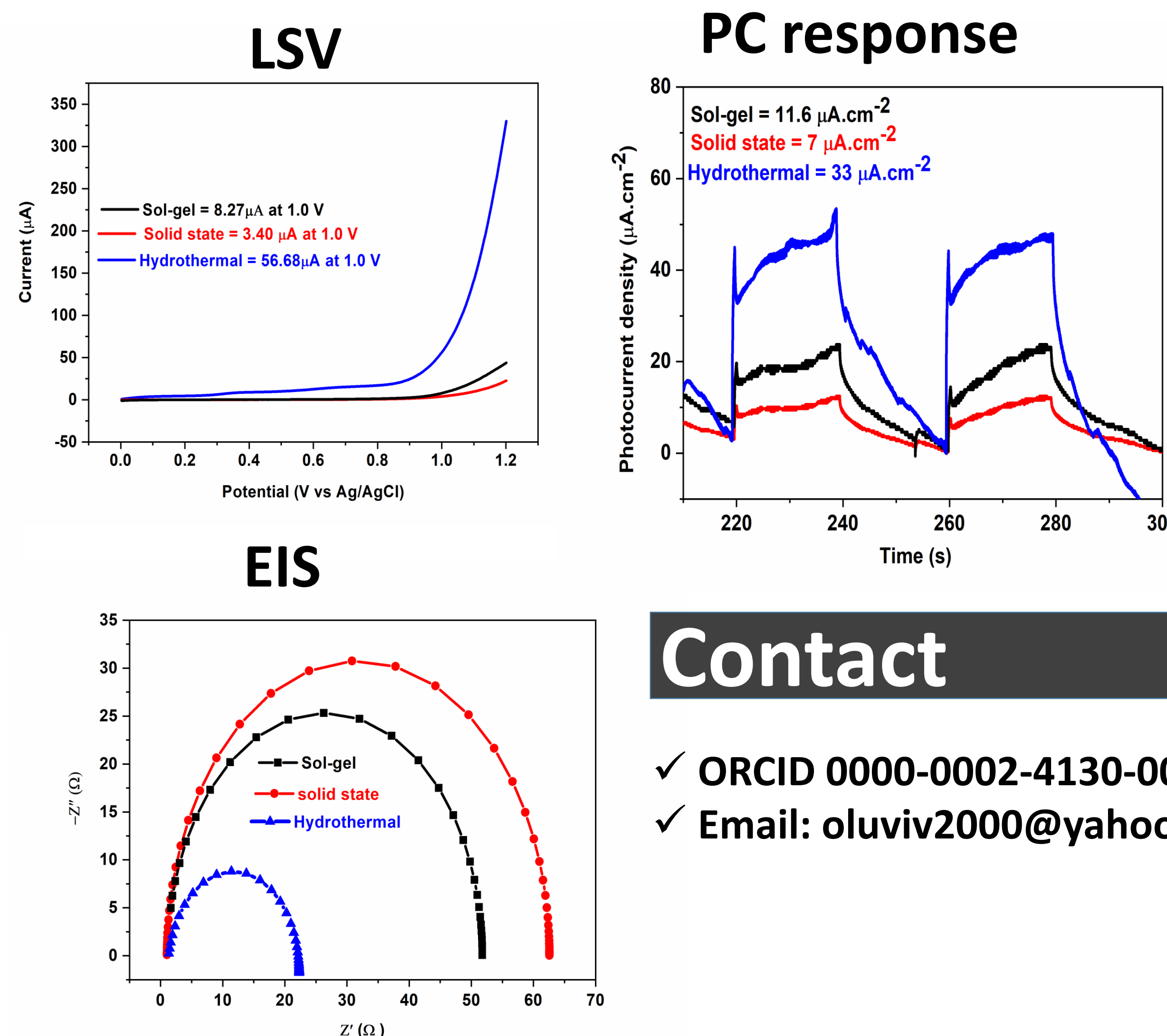
Highlights of the study

- ❑ LFO properties varied with synthesis methods from BET, EIS, PL studies
- ❑ Hydrothermal LFO showed the highest photocurrent response and lowest Rct

BET

Method	Surface Area (m^2/g)	Average pore size (nm)	Total pore volume (cm^3/g)	Pore diameter (nm)
Sol-gel	9.584	7.646	0.0183	131.9
Solid state	3.472	8.686	0.0075	136.2
Hydrothermal	17.439	7.784	0.0339	125.7

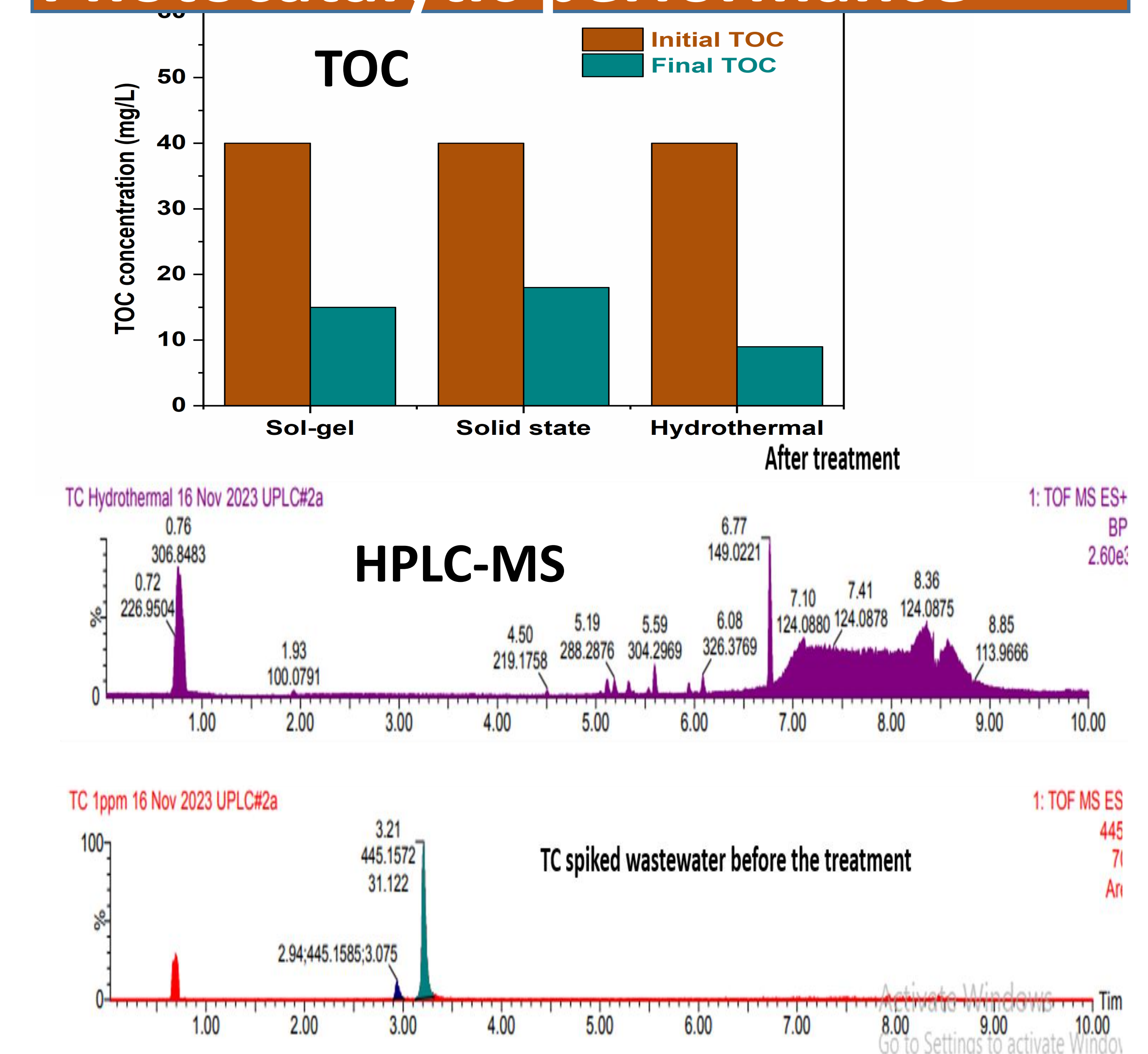
Electrochemical analysis



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Photocatalytic performance



Conclusion

This study shows how that synthesis route can influence the particle size, surface area, light-harvesting capability, and the photocatalytic performance of LaFeO_3 perovskite

References

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- H. Shen et.al, *Mater. Res. Bull.* 84 (2016) 15–24,
- O.V Nkwachukwu, *Next Materials* (2025) 8, p.100879