LANTANUM FERRITE ASPOTENTIAL PHOTO(ELECTRO)CATALYST FOR CO_2 REDUCTION

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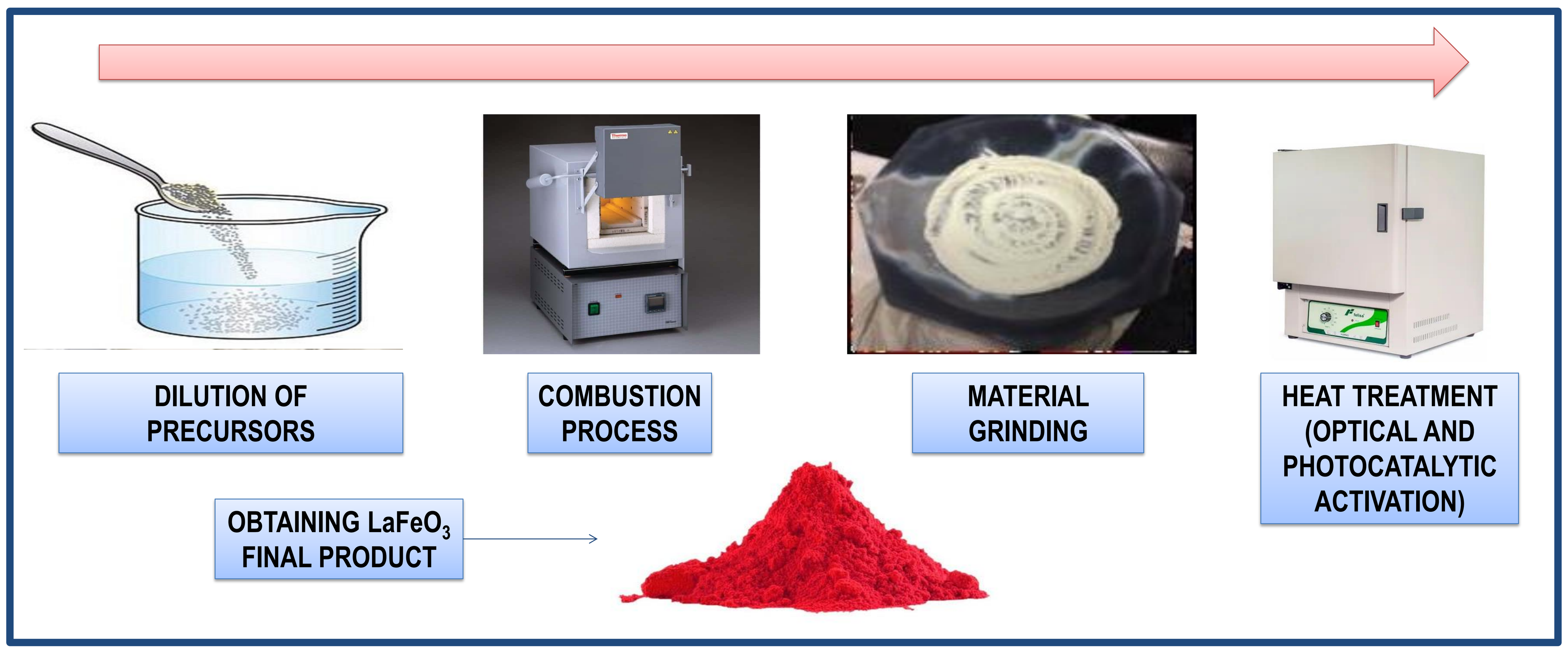
$LaFeO_3$ has been employed as a photocatalyst [1]. Several studies focused on the synthesis and photoreduction of CO_2 under visible light irradiation using $LaFeO_3$ [2, 3]. In this contribution, $LaFeO_3$ was prepared for the reduction of CO_2 into alternative fuels. A combustion method followed by a heat treatment, at 900°C and 1100°C. The obtained materials were characterized optically, morphologically and structurally, in addition to electrochemical tests.. XRD analysis revealed an orthorhombic crystalline phase (JCPDS card No. 88-0641), the sizes of the crystallites were 27.4 nm and 45.7 nm (900 and 1100 °C, respectively) [4]. DRS analysis showed three main absorption bands at 265, 400 and 720 nm; with an approximate band gap of 2.25 and 2.5 eV for the 1100°C and 900°C samples, respectively. Whereas the SEM micrographs showed irregular grains with an average size of 11.7 ± 4.6 µm. To test the photocatalytic activity of the synthesized materials, methylene blue (MB) was used as a model dye using a solar simulator (one sun). Complete degradation of MB was achieved at 230 minutes. Finally, the electrochemical characterization revealed a positive potential of the conduction band around 0.01 V.

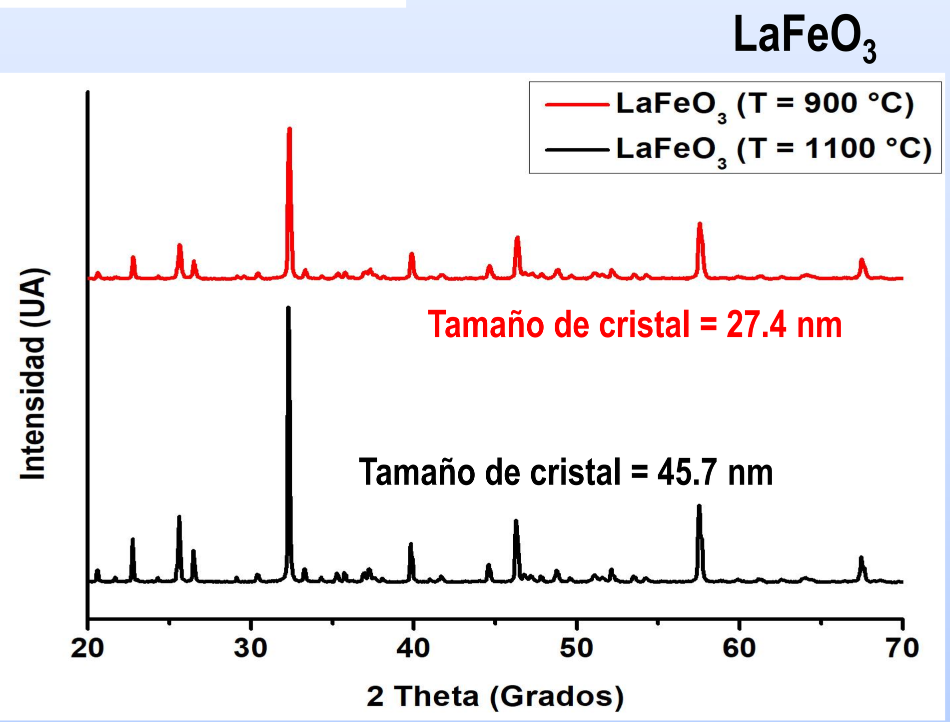
SYNTHESIS OF $LaFeO_3$ (SEQUENCE OF THE PROCESS)

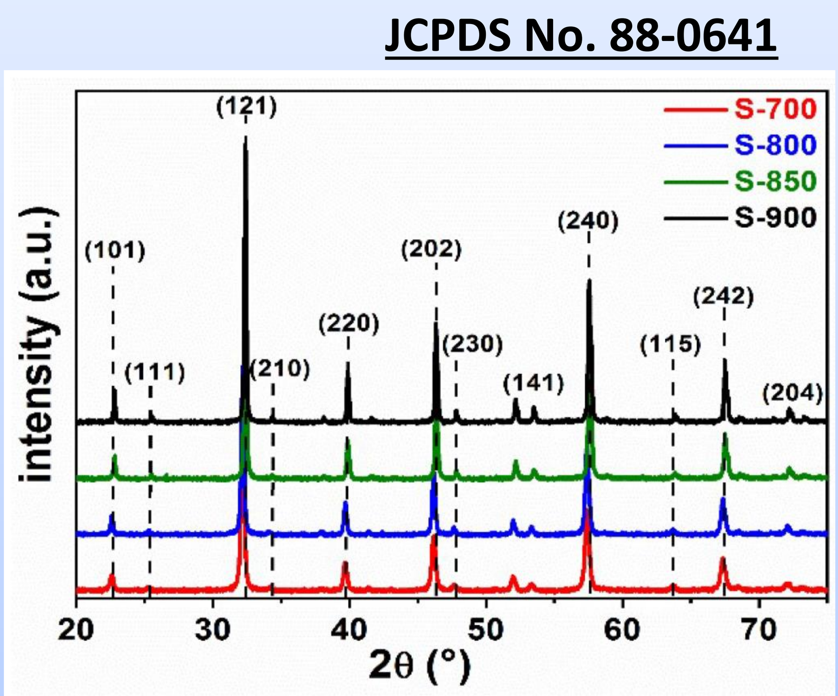


OPTICAL, MORPHOLOGICAL, STRUCTURAL AND ELECTROCHEMICAL CHARACTERIZATION

X RAY DIFFRACTION

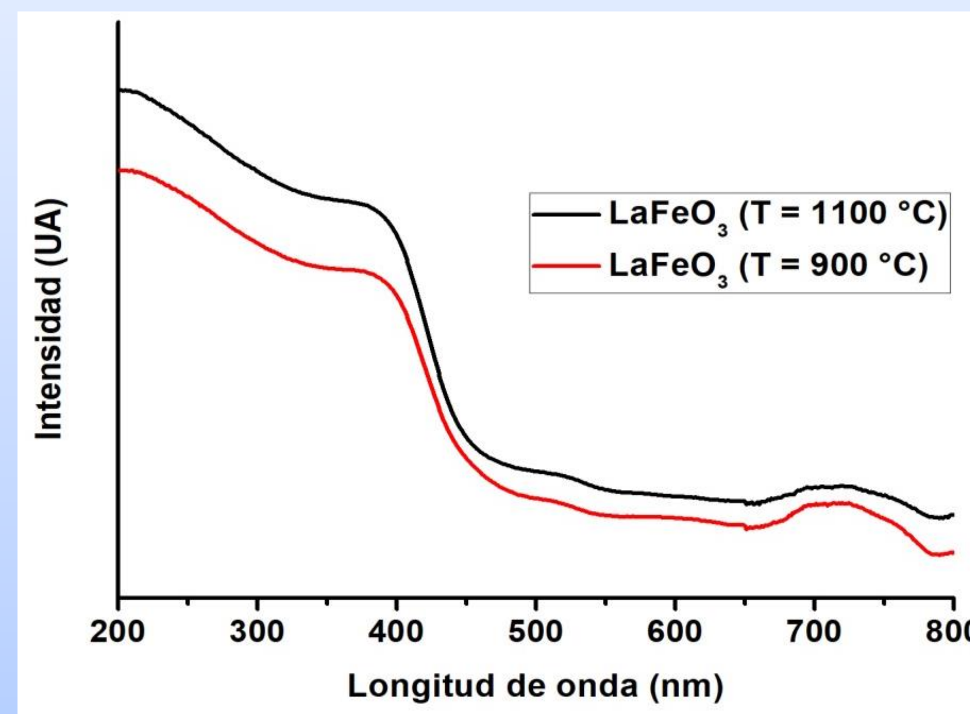
$LaFeO_3$ | JCPDS No. 88-0641

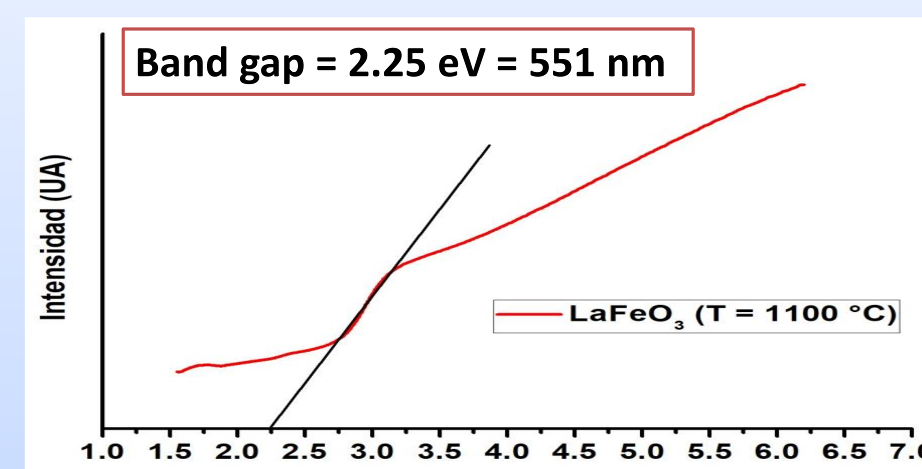


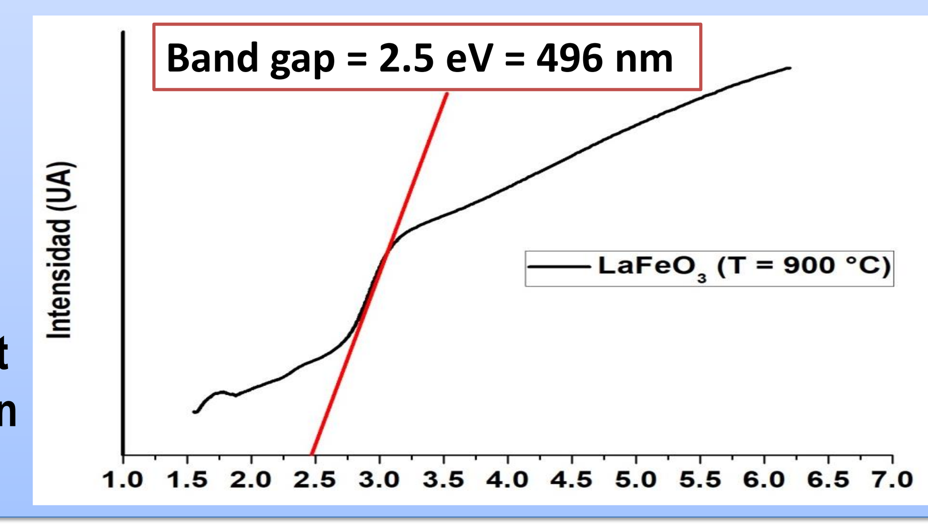


- All diffraction peaks belong to orthorhombic $LaFeO_3$ with ABO_3-type perovskite structure.
- This confirms the effective preparation of a monophasic $LaFeO_3$ perovskite without crystalline impurities such as La_2O_3 or Fe_2O_3

DRS ANALYSIS

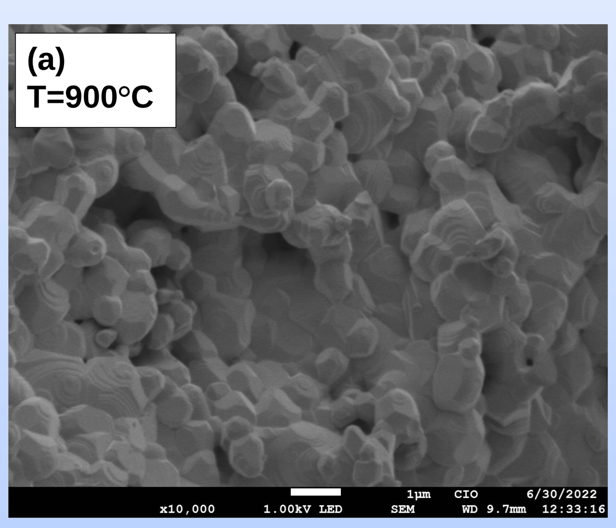


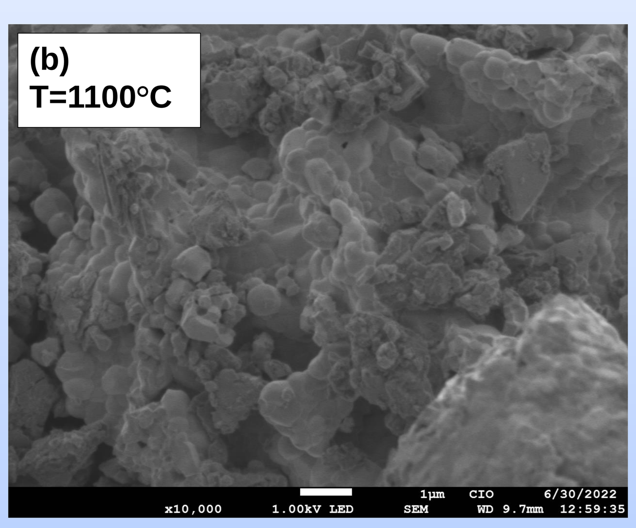




- The T = 1100°C sample absorbed slightly more light energy than the others, showing that the decrease in particle size resulted in a slight redshift.

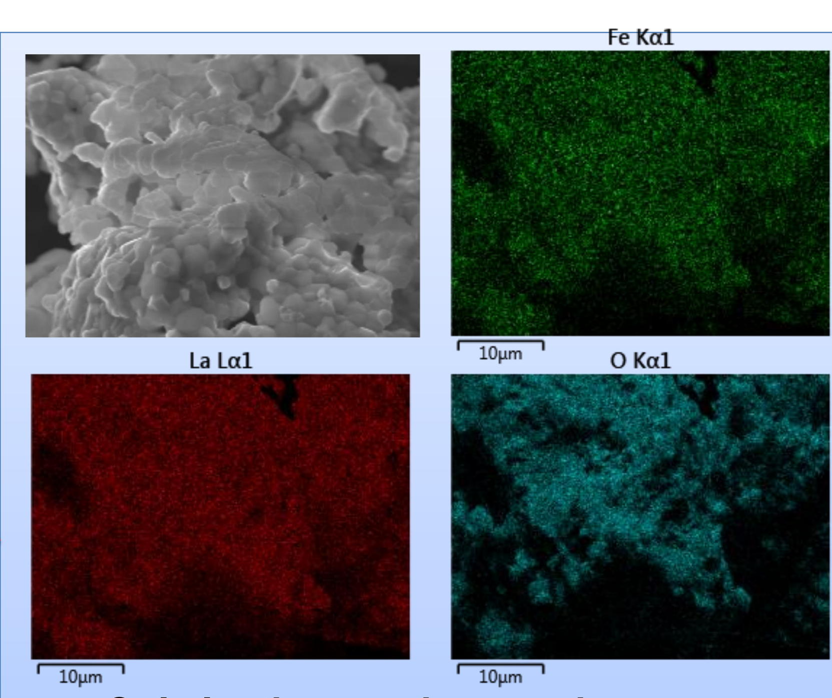
SEM Y EDS ANALYSIS





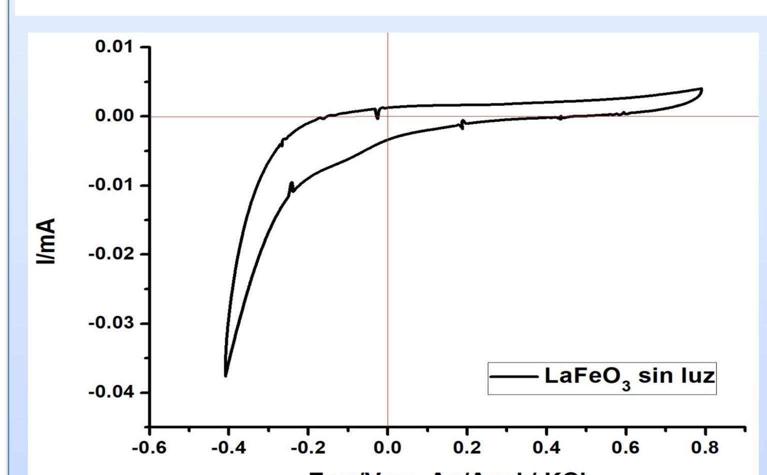
- Particle sizes of T=1100 were found to be significantly smaller than those of T=900, in agreement with the trend of crystallite sizes that were determined by X-rays.

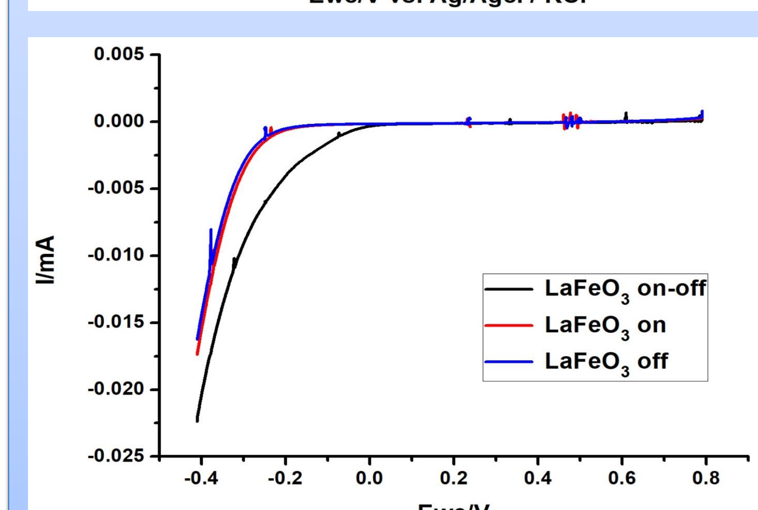
MAP SUM SPECTRUM		
	Wt%	σ
La	62.2	0.1
Fe	19.3	0.1
O	18.5	0.1



- Only lanthanum, iron, and oxygen were present, confirming that the combustion method route leads to a high-purity $LaFeO_3$ photocatalyst.

ELECTROCHEMICAL CHARACTERIZATION

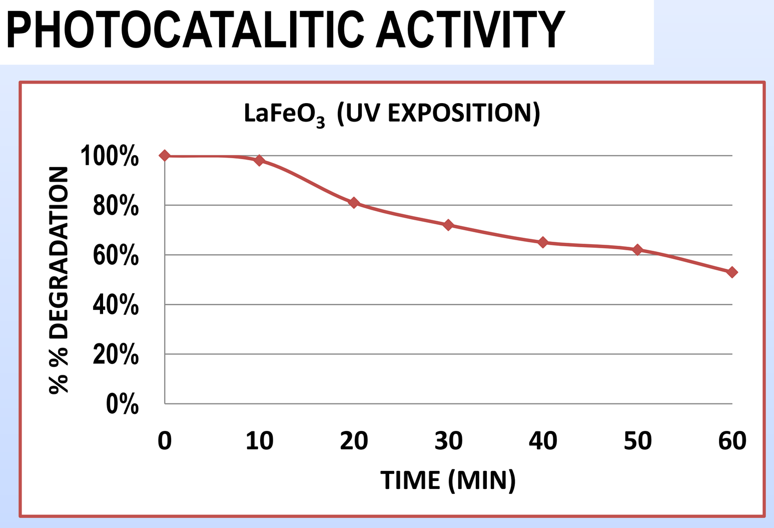


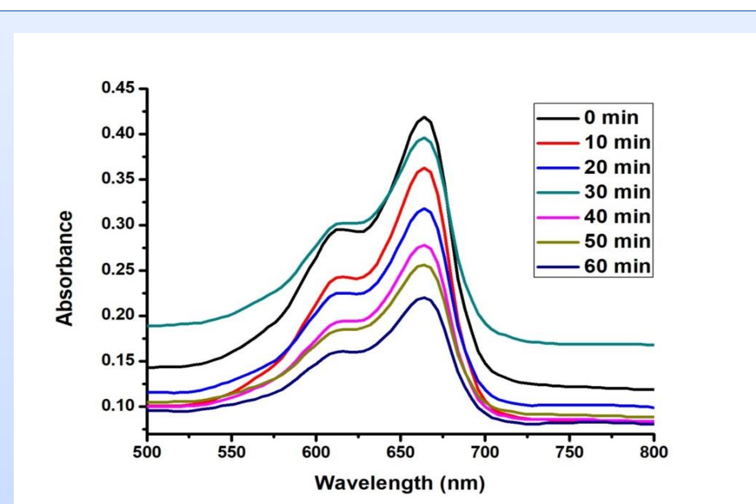


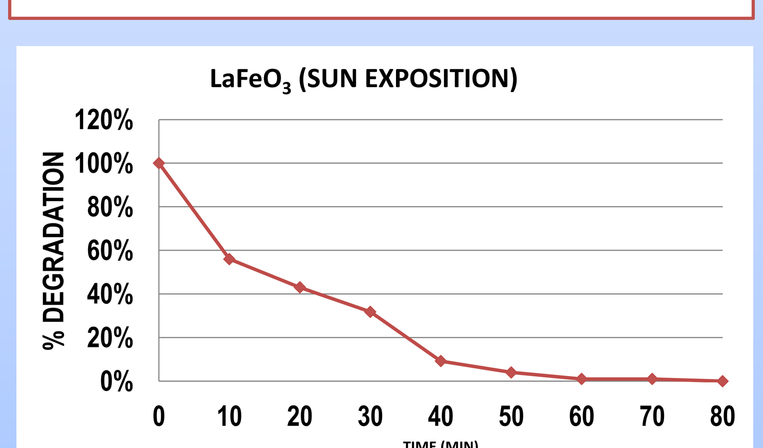
The total photocurrent, we could observe in the VC that the lanthanum ferrite tends to be mostly oxidative.

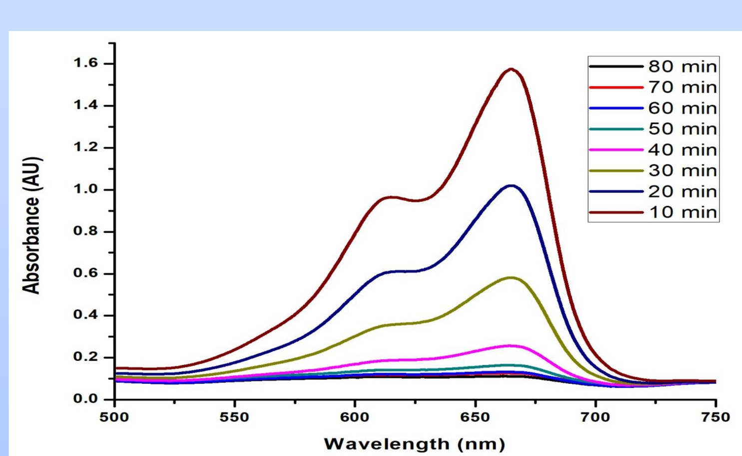
Electrical polarization instead of lighting.

PHOTOCATALITIC ACTIVITY

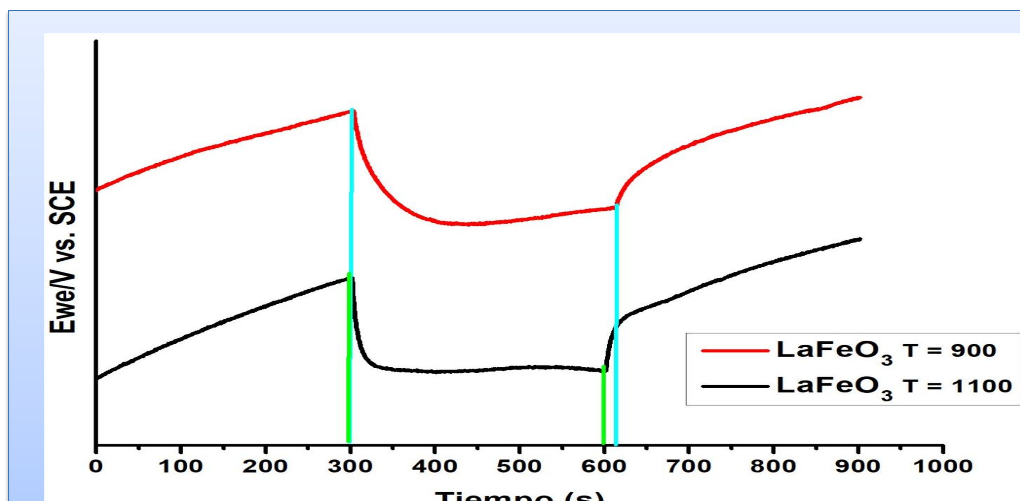








Complete degradation of MB was achieved at 80 minutes.



Highest HPV was 0.01 V

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CONCLUSION

$LaFeO_3$ was synthesized using the combustion route at two different calcination temperatures, **900 and 1100°C**. The most **representative sample** was the one that was calcined at **a temperature of 1100°C** due to a better **defined crystalline structure**, which is attributed to a pure phase of the material and lower bandgap energy. At temperatures below 1100°C the shape of the $LaFeO_3$ samples was amorphous **AND ESPECIALLY A MIXTURE OF PHASES**. Finally, the electrochemical characterization revealed a **positive potential of the CB around 0.01 V**, which explains a low reductive activity observed of $LaFeO_3$ for the reduction of CO_2 to a possible conversion of some value-added product, on the other hand, the potential oxidative increase about proportionally with respect to the aforementioned. In summary, **$LaFeO_3$ is a promising photoelectrocatalytic material for CO_2 reduction.**