# Flexible Photoanodes Based on Hematite Nanoparticles for Solar Water Splitting

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The urgent demand for sustainable energy highlights photoelectrochemical (PEC) water splitting as a promising solar-to-hydrogen conversion method. This approach uses sunlight to drive water electrolysis, producing oxygen and hydrogen [1]. Several n-type semiconductors, such as $Fe_2O_3$, $WO_3$, and $TiO_2$, have shown promise as photoanodes[2,3]. Among them, hematite ($\alpha$-$Fe_2O_3$) stands out due to its natural abundance, chemical stability in aqueous environments, and an appropriate bandgap for solar light absorption [2]. Different flexible substrates were first evaluated through linear sweep voltammetry (LSV) measurements, assessing their electrical properties with and without copper tape to enhance conductivity. Following this, the preparation of a hematite-based paste using commercial nanoparticles (28 nm) was optimized by varying the binder concentration and testing different heating treatments. All pastes were deposited on ITO/PET flexible substrates via drop-casting. Factors such as paste adhesion to the substrate and stability in contact with the electrolyte (0.01 M NaOH) were the main criteria for selecting functional photoanodes. The fabricated photoanodes were then characterized in terms of morphology, structure, and photoelectrochemical performance. Beyond the commercial nanoparticles, different hydrothermal home-made nanoparticles with varied morphologies, ranging from nanocubes to nanoellipses and nanoneedles, were synthesized [4] for future incorporation into pastes with tailored porosities and nanoarchitectures, aiming to enhance photoelectrochemical performance.

## References

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[2] P. Quitério et al, J. Phys. Chem. C 124, 12897 (2020).
[3] Gonçalves et al., ACS Appl. Mater. Interfaces 16, 47, 64389–64409 (2024).
[4] S. Caspani et al., ACS Appl. Mater. Interfaces 16, 18348 (2025).

## Figures

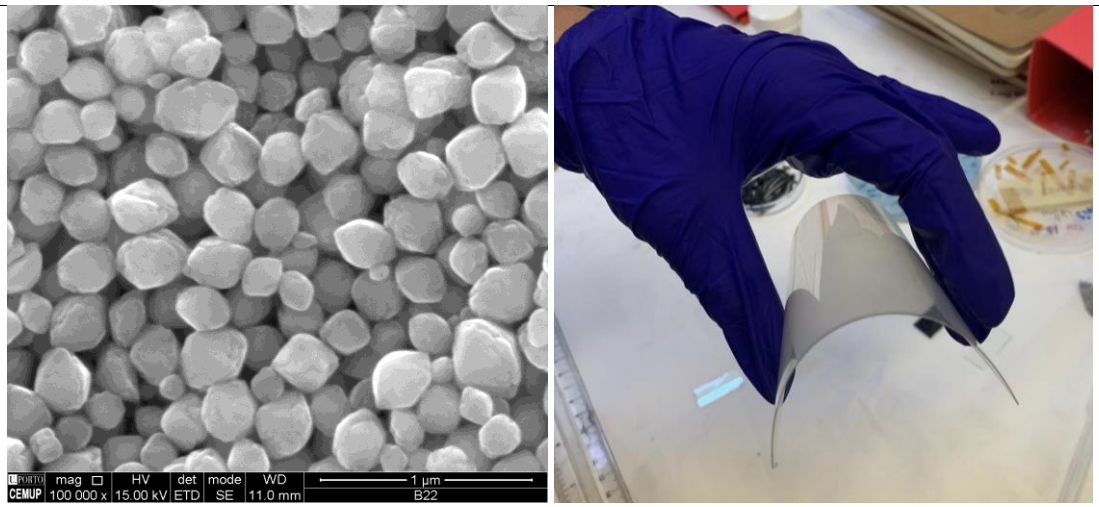


**Figure 1:** SEM image of hematite nanoparticles deposited on the Flexible ITO/PET substrate.