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DEVELOPMENT OF COMPOSITE ELECTRODES FOR EFFICIENT GENERATION OF GREEN HYDROGEN THROUGH PHOTOVOLTAIC ENERGY

Isadora dos Santos Pires Soares, Leandro Ferreira Pinto, Renivaldo José dos Santos, Leonardo Lataro Paim.

São Paulo State University (UNESP), School of Engineering and Sciences, Rosana

INTRODUCTION & AIM

Hybrid systems for hydrogen production via photovoltaic electrolysis (PVEL) are recognized as environmentally clean but economically impractical. Consequently, a critical need has emerged for novel materials in both photovoltaic panels and electrolysis cell electrodes. (Arsad et al., 2022).

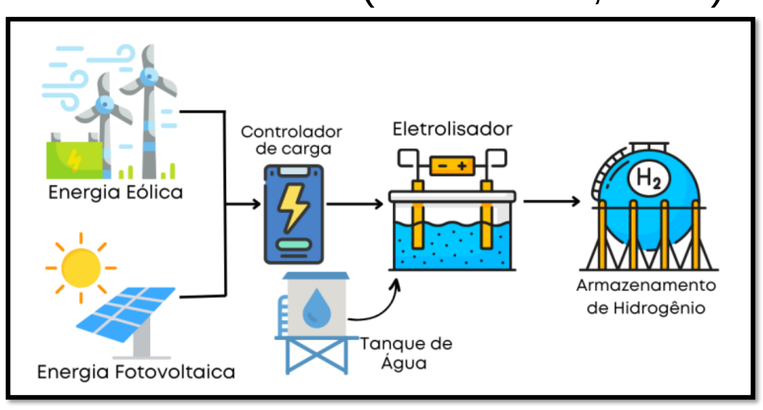

Figure 1. Schematic of a hydrogen Generation system using wind and photovoltaic energy

METHOD

Nanoparticle synthesis: The mixing of $FeCl_3 \cdot H_2O$ and $FeSO_4$ solutions in specific proportions followed by the gradual addition of na aqueous NH_3 solution and finally being separated by a Strong magnet.

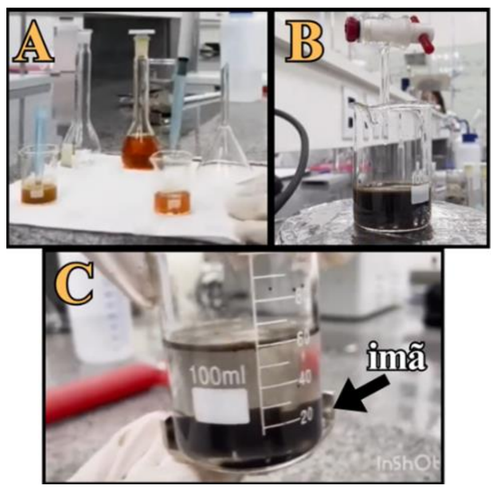

Figure 2. Steps in nanoparticle synthesis

Characterization of Materials: High-resolution environmental scanning electron microscopy (SEM) and na EDS module were employed.

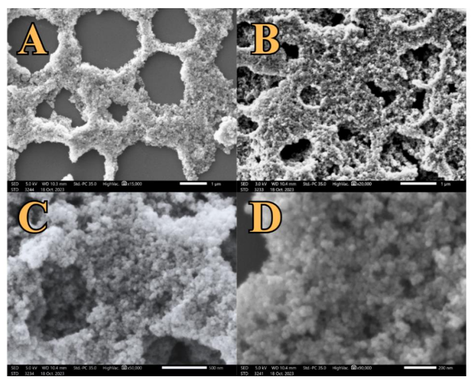

Figure 3. Scanning electron microscopy images of Fe3O4 nanoparticle samples at different magnifications: A – 15000x; B – 20000x; C – 50000x; D – 90000x.

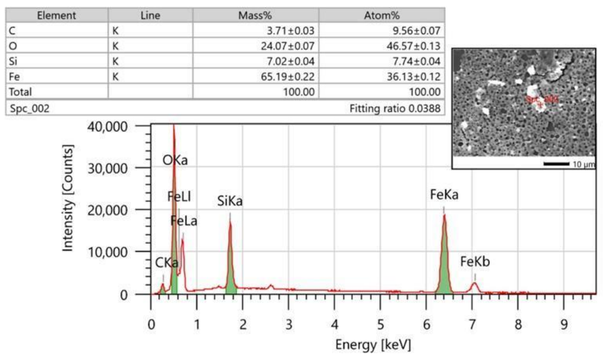

Figure 4. EDS spectrum of Fe3O4 nanoparticles. Inserted: Table with semi-qualitative data.

Electrochemical analyzes: Cyclic voltammetry and chronoamperimetry analyzes were carried out.

RESULTS & DISCUSSION

The best results in chronoamperimetry and cyclic voltammetry tests were observed using the electrolyte KH_2PO_4 0.1M

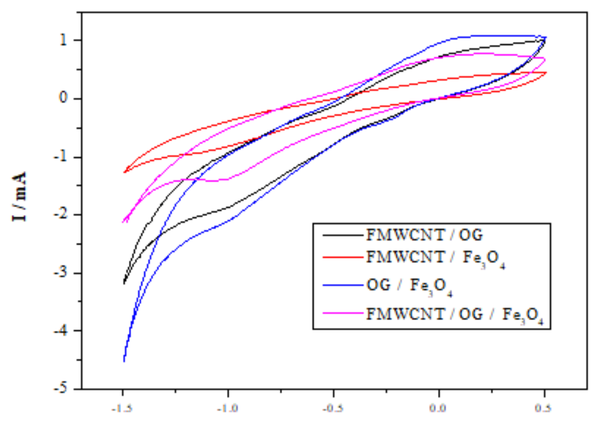

Figure 5. Cyclic voltammograms of the modified electrodes at 50 mV s^1

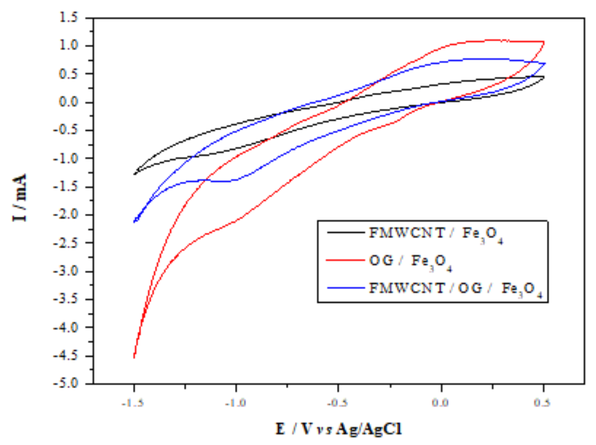

Figure 6. Cyclic voltammograms only with the modified electrode containing iron nanoparticles at 50 mV s^1

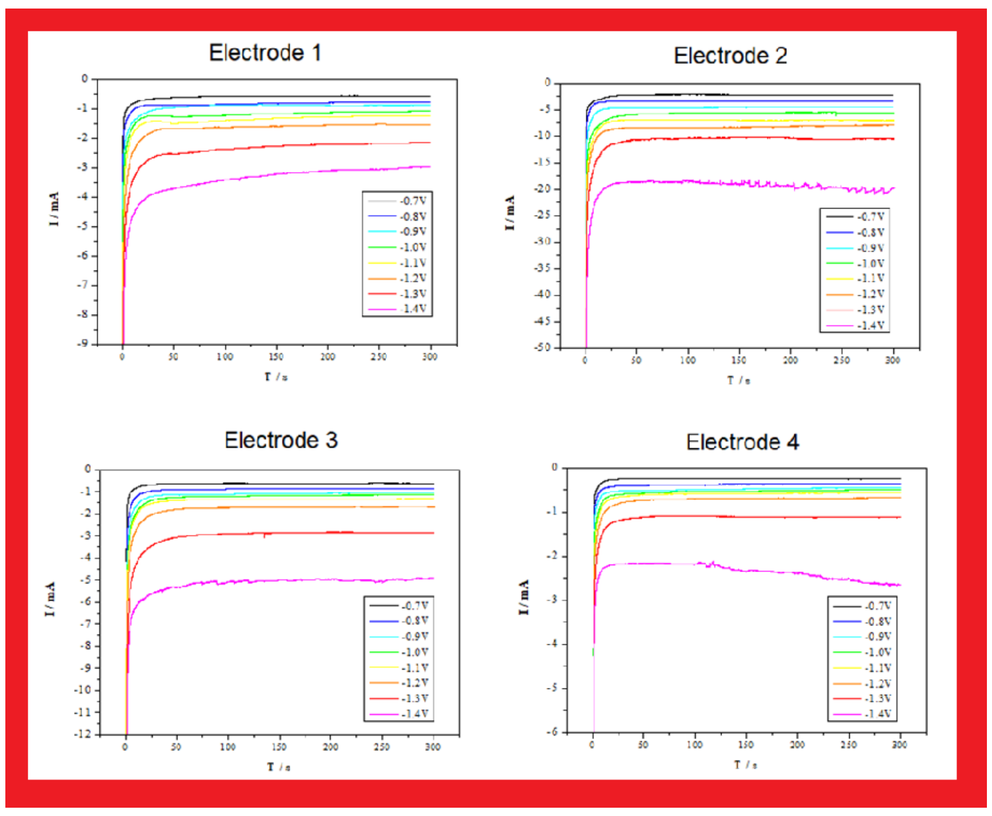

Figure 7. Comparison of chronoamperimetry of the four modified electrodes.

CONCLUSION

The discoveries acquired in the electrochemical analyzes highlighted the effectiveness of the electrode in facilitating the evolution of hydrogen under neutral pH, emphasizing its potential in practical systems for generating clean hydrogen powered by photovoltaic energy.

FUTURE WORK / REFERENCES

ARSAD, A. Z. et al. Hydrogen energy storage integrated hybrid renewable energy systems: A review analysis for future research directions. **International Journal of Hydrogen Energy**, v. 47, n. 39, p. 17285–17312, 5 2022.