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Synthesis and Evaluation of Graphene and Nanocomposites for Applications in Electrochemical Devices

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Introduction



Figure 1. AI-generated schematic illustration of GO/MnO_x nanocomposite synthesis, Mn-rich byproduct valorization, and electrochemical applications.

Objective

To develop and characterize GO/MnOx nanocomposites using manganese oxide obtained as a byproduct from the graphene synthesis process, aiming at their application in electrodes for electrochemical energy storage systems.

Methodology

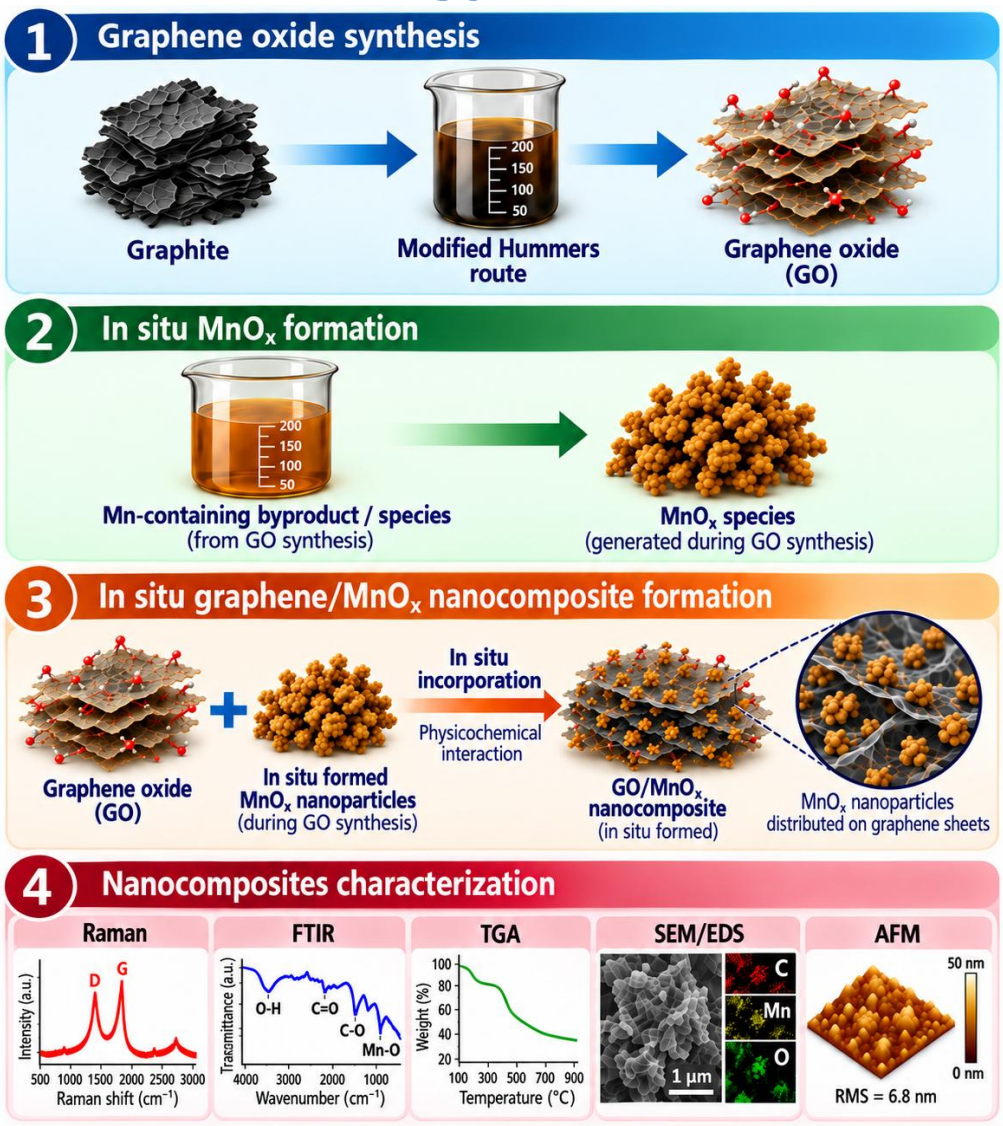

Figure 2. AI-generated schematic of GO/MnO_x nanocomposite synthesis and characterization.

References

1. Geim, A. K.; Novoselov, K. S. Nature Materials, 2007, 6, 183–191.
2. Hummers, W. S.; Offeman, R. E. Journal of the American Chemical Society, 1958, 80, 1339.
3. Pei, S.; Cheng, H.-M. Carbon, 2012, 50, 3210.

Results e discussion

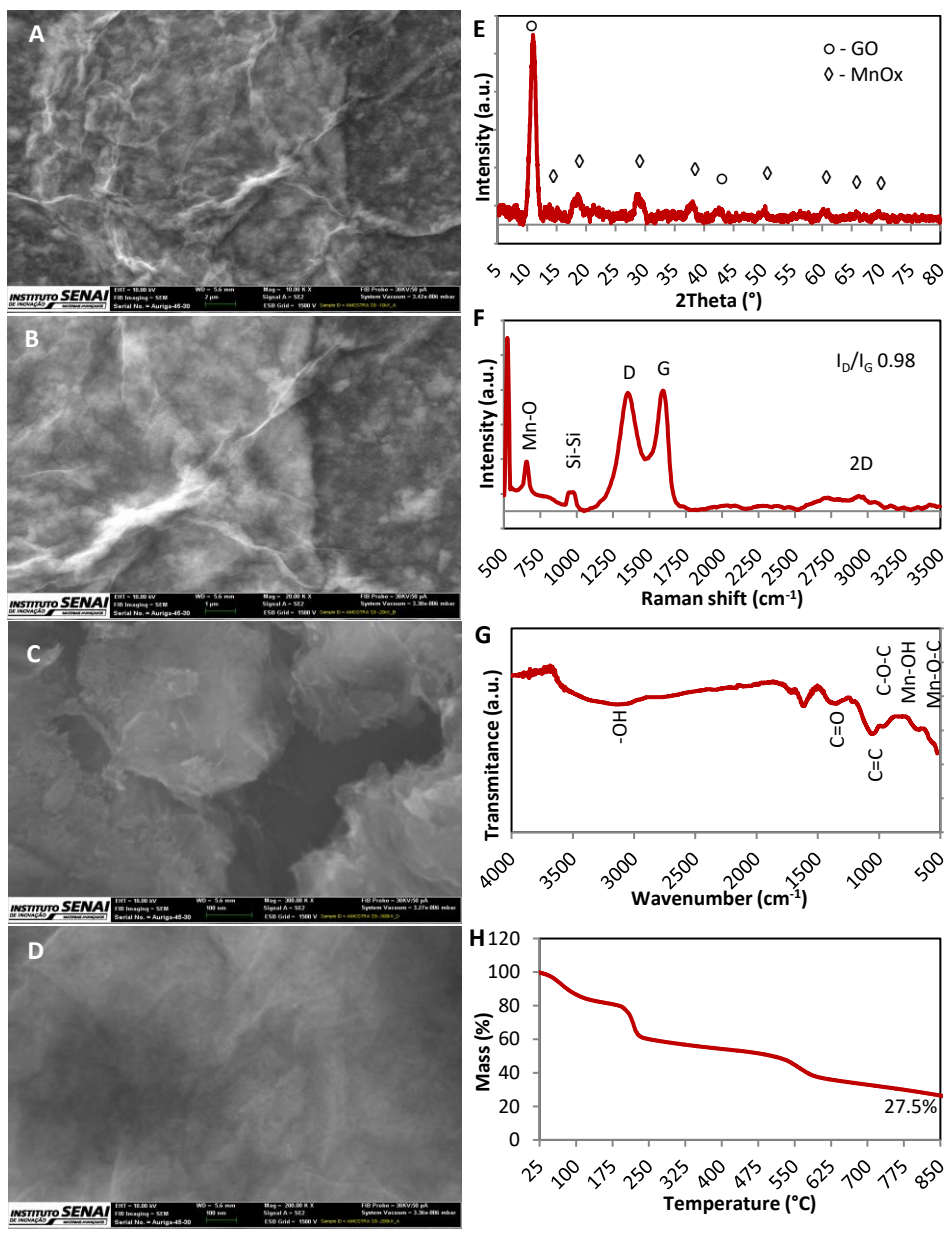

Figure 3. GO/MnOx characterization: (A-D) SEM, (E) XRD, (F) Raman, (G) FTIR and (H) TGA.

- The graphene/MnO_x nanocomposite exhibited a wrinkled and lamellar morphology with MnO_x-containing regions distributed over the graphenic sheets.
- XRD confirmed the presence of crystalline manganese oxide phases, while Raman spectroscopy showed the characteristic D and G bands of graphenic materials.
- FTIR indicated oxygen-containing functional groups and interactions between the carbon matrix and MnO_x.
- TGA revealed progressive mass loss associated with adsorbed species, functional-group decomposition, and thermal degradation of the carbonaceous structure.

Conclusion

The obtained results confirmed the successful formation of the graphene/MnO_x nanocomposite, preserving the characteristic structural features of the graphenic material while incorporating manganese oxide phases. The morphological and spectroscopic analyses indicated effective interaction between the carbonaceous matrix and MnO_x and showing promising characteristics for electrochemical applications.

Acknowledgments

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