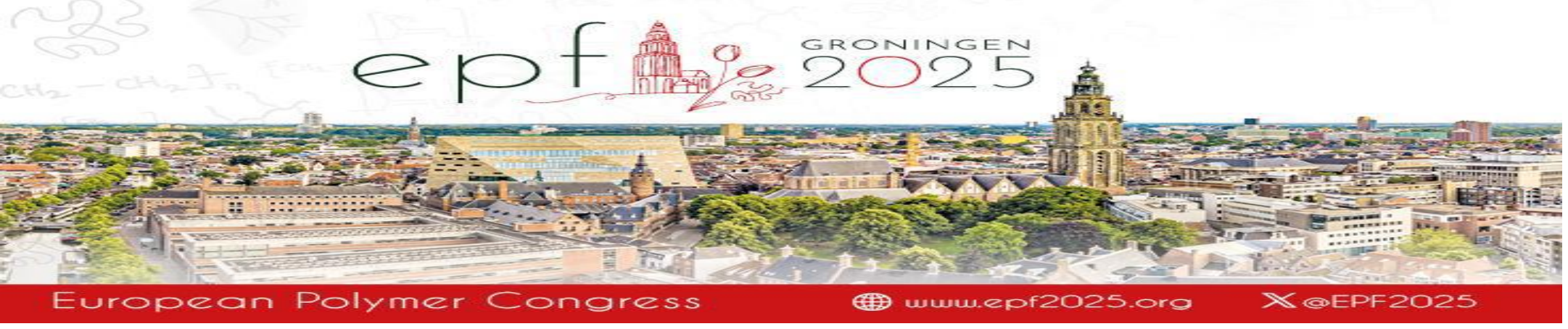

Room-Temperature CO_2 Sensing via Electrochemically Synthesized Polypyrrole/Functionalized Graphene Nanocomposites

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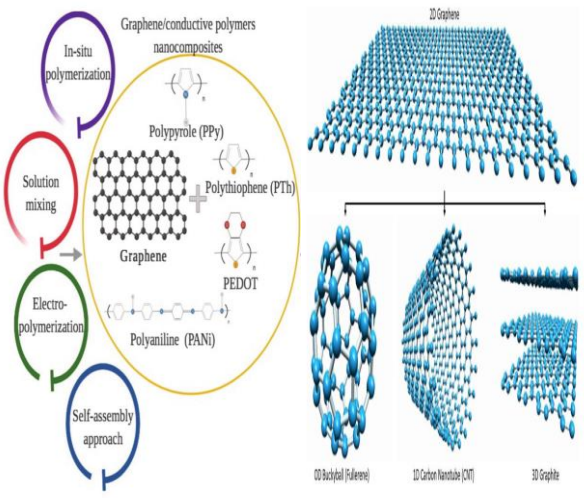
Aims and Methods



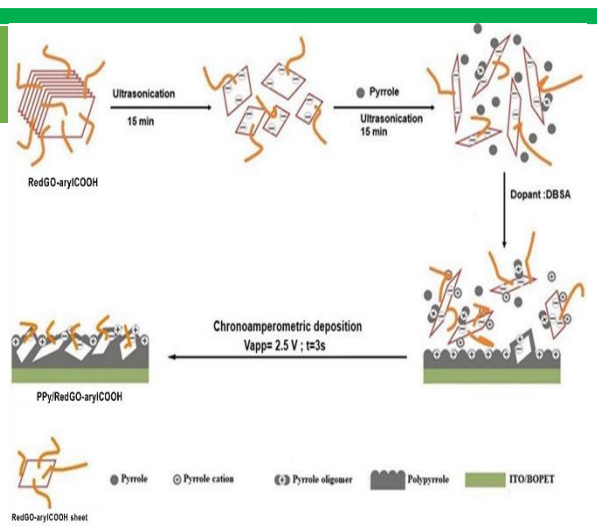


***Figure 1**: Sketch illustrating the approach of the electrodeposition of nanocomposite*

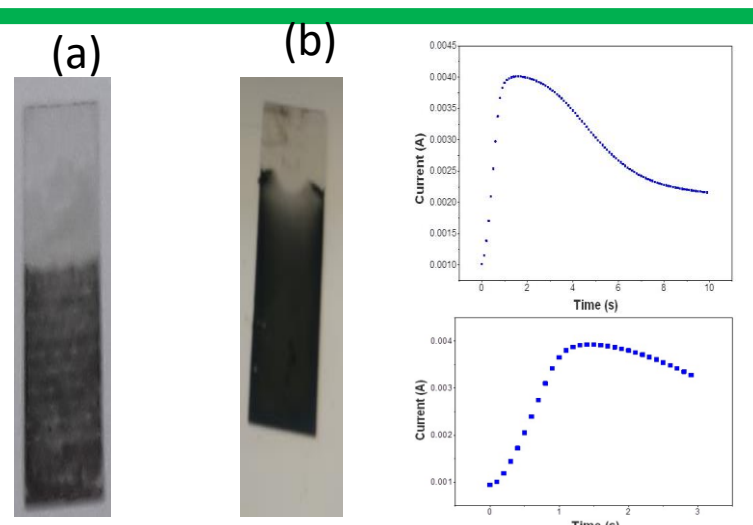


***Figure 2**: Photographs of the electrodeposited films: (a) PPy/RedGO, (b) PPy/RedGO-arylCOOH on ITO/PET substrate.*

Characterization Results

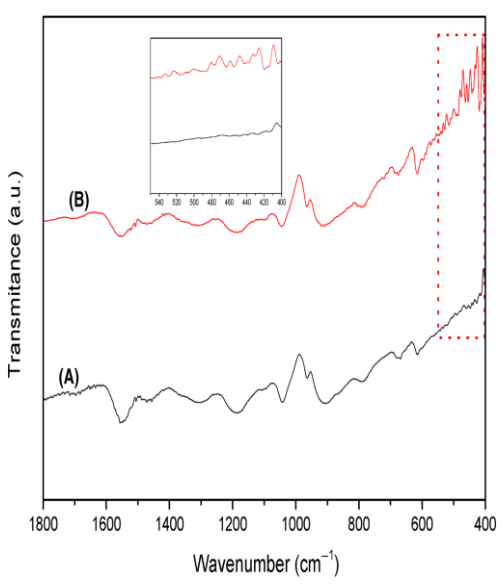


***Figure 3**: FTIR spectra of (A) PPy/ RedGO and (B) PPy/RedGO-arylCOOH films. Insert: Zoom from 550 to 400 cm-1.*

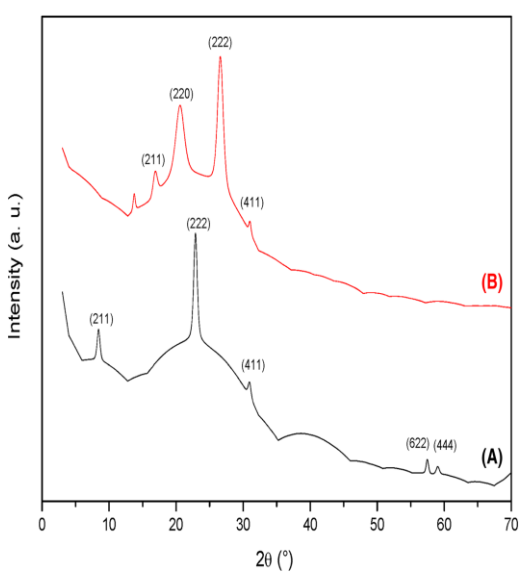
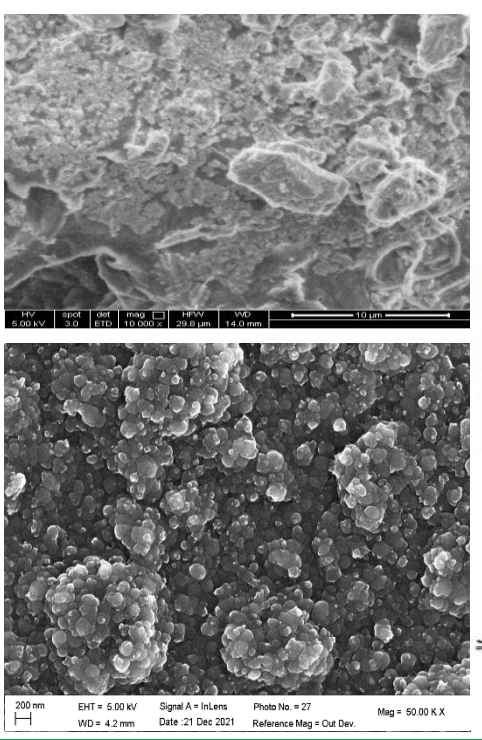
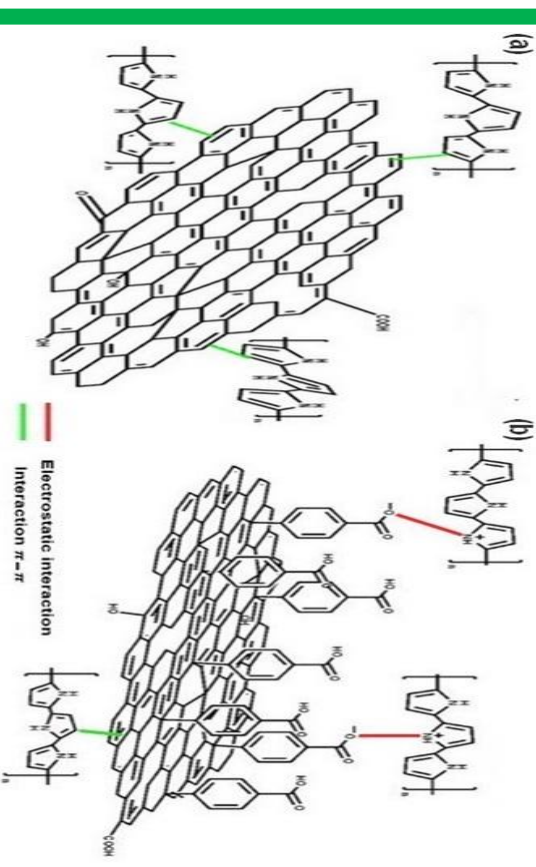
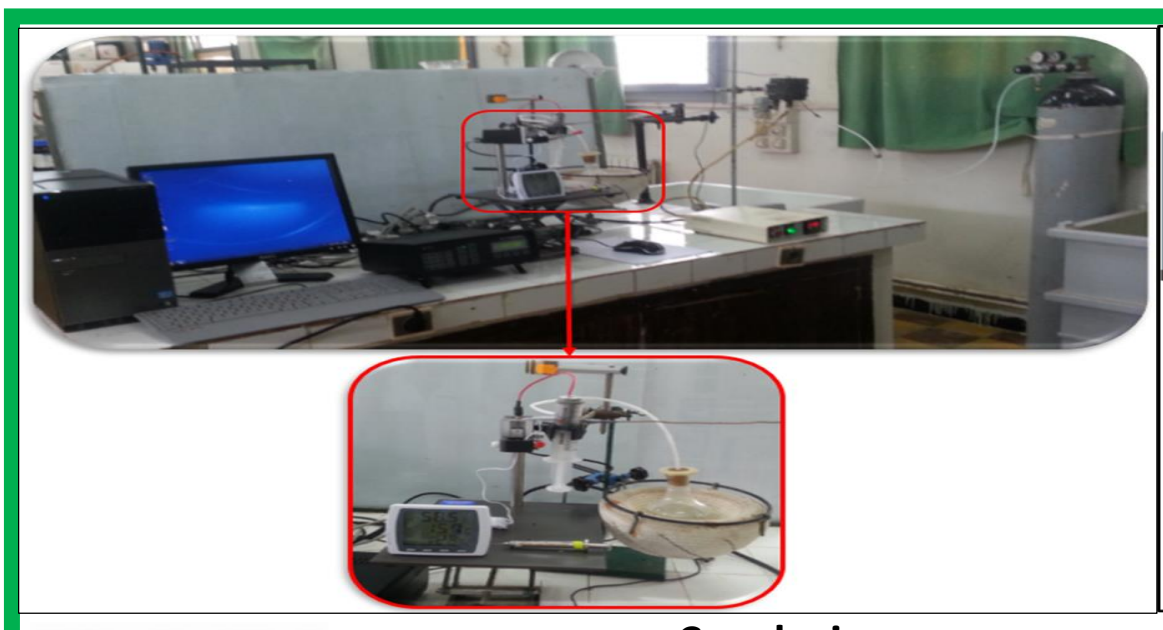
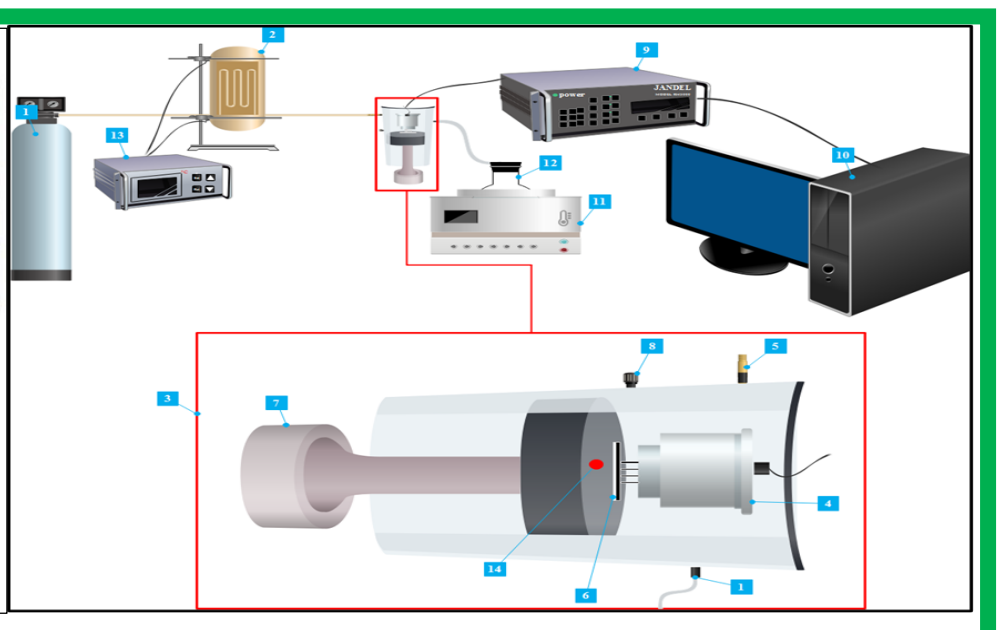


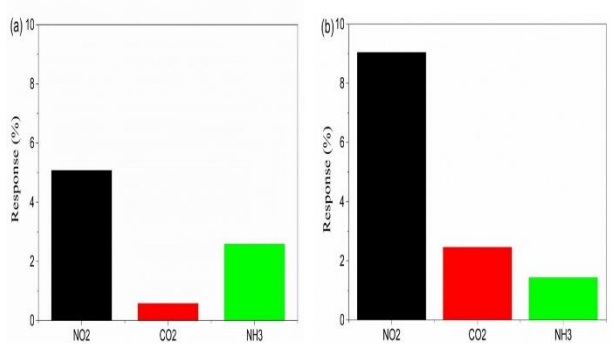
***Figure 4**: XRD patterns of (A) PPy/ RedGO and (B) PPy/RedGO-arylCOOH composites.*

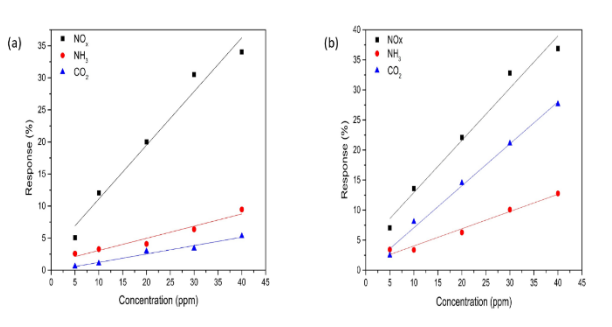












Conclusion

The functionalized PPy/RedGO-arylCOOH nanocomposite exhibited significantly enhanced CO_2 sensing performance, with high sensitivity (0.698%/ppm), excellent linearity (R^2 = 0.991), and improved selectivity compared to non-functionalized PPy/RedGO. This improvement results from the synergistic effects of carboxyl (-COOH) surface functionalization and uniform nanoscale morphology, which promote better charge transfer and gas interaction.

The electrochemical synthesis process enabled precise control over material dispersion and film formation, ensuring reproducibility and scalability on flexible substrates.

This study highlights the potential of PPy/graphene hybrid materials as efficient, low-power gas sensors for real-time environmental monitoring and lays the foundation for future integration into smart sensing networks.

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