HYBRID COMPOSITES OBTAINED BY THE ADDITION OF α-Al_2O_3 POWDER OR Eu_2O_3 NANOPARTICLES TO THE IN-SITU POLYMERIZATION OF *P*-ANISIDINE

*[1]D. C. Menezes, [2]P. O. Santiago, [2]Y. P. Mascarenhas, [3]E. A. Sanches
[1]*São Carlos Engineering School, University of São Paulo*
[2]*São Carlos Physics Institute, University of São Paulo*
[3]*Physics Department of Federal University of Amazonas*

Despite electrical, thermal, structural, and morphological properties of *ortho*– and *meta*–substituted poly(methoxyaniline) have been widely reported, there are significant lack of systematic research on its *para*-substituted, here named poly(*p*-anisidine) (PPA). Standard chemical oxidative polymerization of *p*-anisidine was performed [1]. Solution I was prepared by solubilizing 2.0 g of *p*-anisidine monomer in HCl 1M, and Solution II was obtained by adding 4.0 g of ammonium persulfate also in HCl 1M. Solution II was incorporated dropwise to Solution I under constant stirring. After 3 hours, the dark powder was vacuum filtered, washed, and kept in a desiccator until reach constant weight. For the polymer-ceramic hybrid composite synthesis, the same method as described above was performed to obtain the polymer composites, PPA/α-Al_2O_3 and PPA/Eu_2O_3. In each case, the components added to Solution I were α-Al_2O_3 or Eu_2O_3 respectively. Synthesis was conducted at 25 °C and the oxides were added at 4 wt.% of monomer weight. X-ray diffraction was obtained with CuKα radiation, λ = 1.54 Å, 40 kV, and 20 mA. The scan mode was performed with 0.02°/s step, velocity of 5°/min, in the 2θ = 3 – 73° interval. The XRD pattern of PPA showed a broad halo, between 2θ = 15° and 34°, and centered at 2θ = 24.5°, due to the polymer amorphous phase, a strong peak at 2θ = 5.2° and some small, superimposed peaks indicated some crystallinity [2]. Similar patterns were obtained with both composites, exhibiting a smoother halo indicating some crystallinity improvement. Characteristic XRD patterns corresponding to the respective oxides confirms the occurrence of both phases in each composite material. With higher crystallinity percentages, we expect to get properties, in general, enhanced for overall applications. Thermogravimetric (TG) analysis already indicates improvement in thermal stability among the composites forms [3]. We expect that electrical conductivity measurements, may reveal similar behavior gathering through PPA and its composites a wider range of semiconducting properties.

References

[1] S. Bhandari, "Polyaniline: Structure and Properties Relationship," *Polyaniline Blends, Composites, and Nanocomposites*, pp. 23–60, Jan. 2018, doi: 10.1016/B978-0-12-809551-5.00002-3.

[2] L. Rodrigues de Oliveira *et al.*, "Head-to-Tail and Head-to-Head Molecular Chains of Poly(p-Anisidine): Combined Experimental and Theoretical Evaluation," 2022, doi: 10.3390/molecules27196326.

[3] B. de A. Feitosa *et al.*, "Nanocomposites based on the cellulose extracted from the Amazon Peperomia pellucida and polyaniline derivatives: structural and thermal properties," *Chemical Papers*, vol. 75, no. 5, pp. 1809–1821, May 2021, doi: 10.1007/s11696-020-01435-4.