

# Investigation of Optical and Electrical Property of Polyaniline-Zinc Ferrite Nanocomposites

Priyanka Kolhar<sup>1</sup> and Basavaraja Sannakki<sup>2</sup>

Department of Physics, Gulbarga University, Kalaburgi, Karnataka, India<sup>1,2</sup>

Correspondence: priyankakolhar25@gmail.com<sup>1</sup>

sannakki.phy@gmail.com<sup>2</sup>

**Abstract:** Zinc Ferrite nanoparticles are synthesised by solution combustion method with urea as fuel. The prepared ferrite nanoparticles are added to the Polyaniline polymer during chemical oxidative polymerization to get Polyaniline-Zinc ferrite nanocomposites in different weight ratios (10%, 30% and 50%). XRD confirms the formation of the nanocomposite as the XRD spectrum of the composite has characteristic sharp peaks of zinc ferrite and the characteristic broad peak of Polyaniline. From the UV-Vis absorption data, the optical direct band gap is estimated with the help of Tauc plot and the obtained optical band gaps are found to decrease as the content of Zinc ferrite in polyaniline composites increases. DC conductivity increases as the percentage of zinc ferrite increases in the polyaniline matrix.

**Keywords:** Zinc Nano-ferrite, Chemical oxidative polymerization, Composites, Optical direct band gap, DC conductivity

## REFERENCES

- [1]. McManus PM, Cushman RJ, Yang SC. Influence of oxidation and protonation on the electrical conductivity of polyaniline. *Journal of Physical Chemistry*. 1987 Jan;91(3):744-7.
- [2]. Samuelson LA, Druy MA. Kinetics of the degradation of electrical conductivity in polypyrrole. *Macromolecules*. 1986 May;19(3):824-8.
- [3]. Furukawa Y, Akimoto M, Harada I. Vibrational key bands and electrical conductivity of polythiophene. *Synthetic Metals*. 1987 Feb 1;18(1-3):151-6.
- [4]. Boeva ZA, Sergeev VG. Polyaniline: Synthesis, properties, and application. *Polymer Science Series C*. 2014 Sep;56(1):144-53.
- [5]. Bhadra S, Khastgir D, Singha NK, Lee JH. Progress in preparation, processing and applications of polyaniline. *Progress in polymer science*. 2009 Aug 1;34(8):783-810.
- [6]. Badi N, Roy AS, Al-Aoh HA, Alghamdi SA, Alatawi AS, Ignatiev A. Synthesis of Hybrid Polyaniline-Graphene oxide-Sulfur Nanocomposite Fibers Through Ice Nucleation as a Cathode Materials for Lithium-Sulfur Battery. *Materials Science for Energy Technologies*. 2023 Mar 16.
- [7]. Borode T, Wang D, Prasad A. Polyaniline-based Sensor for Real-time Plant Growth Monitoring. *Sensors and Actuators A: Physical*. 2023 Mar 23:114319.
- [8]. Koventhan C, Chung YC, Lo AY, Weng HC, Hung WH. Development of a polyaniline/CMK-3/hydroquinone composite supercapacitor system. *Materials Chemistry and Physics*. 2023 Jan 12:127369.
- [9]. Kumar S, Fu YP. ZnCo-layered double hydroxides coupled polyaniline-derived porous carbon: An efficient electro-catalyst towards supercapacitor and fuel cells application. *Journal of Energy Storage*. 2023 Jun 1;62:106862.
- [10]. Rashid IA, Hamza A, Asim S, Zubair K, Shakir HF, Afzal A, Zubair Z. Achieving enhanced electromagnetic shielding by novel flexible rubber based nanocomposite with the incorporation of nickel spinal ferrites and polyaniline. *Synthetic Metals*. 2023 May 1;295:117339.
- [11]. Liu X, Ji R, Yang M, Chen W, Chen H, Song X, Liu J, Zhang M, Zhang L. Facilitating enhanced microwave absorption properties of barium hexaferrite/polyaniline composites based on tunable interfacial polarization by rare earth doping. *Journal of Alloys and Compounds*. 2023 Mar 15;937:168391.

- [12]. Singh A, Singh A, Singh S, Tandon P, Yadav BC, Yadav RR. Synthesis, characterization and performance of zinc ferrite nanorods for room temperature sensing applications. *Journal of Alloys and Compounds*. 2015 Jan 5;618:475-83.
- [13]. Yang Y, Liu X, Yang Y, Xiao W, Li Z, Xue D, Li F, Ding J. Synthesis of nonstoichiometric zinc ferrite nanoparticles with extraordinary room temperature magnetism and their diverse applications. *Journal of Materials Chemistry C*. 2013;1(16):2875-85.
- [14]. Kolhar P, Sannakki B. Investigation of the electrical properties of synthesised polyaniline-magnesium ferrite composites. *Materials Today: Proceedings*. 2023 Mar 11
- [15]. Hefnawy MA, Medany SS, El-Sherif RM, Fadlallah SA. NiO-MnO<sub>x</sub>/Polyaniline/Graphite Electrodes for Urea Electrocatalysis: Synergetic Effect between Polymorphs of MnO<sub>x</sub> and NiO. *ChemistrySelect*. 2022 Mar 29;7(12):e202103735.
- [16]. Pund SN, Nagwade PA, Nagawade AV, Thopate SR, Bagade AV. Preparation techniques for zinc ferrites and their applications: A review. *Materials Today: Proceedings*. 2022 Mar 5.
- [17]. Rashid IA, Hamza A, Asim S, Zubair K, Shakir HF, Afzal A, Zubair Z. Achieving enhanced electromagnetic shielding by novel flexible rubber based nanocomposite with the incorporation of nickel spinal ferrites and polyaniline. *Synthetic Metals*. 2023 May 1;295:117339.
- [18]. Zeshan M, Ali M, Alanazi MM, Abdelmohsen SM, Khosa RY, Al-Sehemi AG, Ansari MZ, Tayeb RA, Farid HM, Rahman MM. Study of SrEr<sub>0.04</sub>Fe<sub>1.96</sub>O<sub>4</sub>/PANI nano-composites for high-frequency applications. *Ceramics International*. 2023 Mar 24.
- [19]. Patil R, Roy AS, Anilkumar KR, Jadhav KM, Ekhelikar S. Dielectric relaxation and ac conductivity of polyaniline-zinc ferrite composite. *Composites Part B: Engineering*. 2012 Dec 1;43(8):3406-11