

REFERENCE

- Abd-Elkader, O. H., Deraz, N. M., & Aleya, L. (2023). Effects of zinc substitution on the microstructural and magnetic characteristics of cubic symmetry nickel ferrite system. *Symmetry*, 15(5). <https://doi.org/10.3390/sym15050975>
- Aggarwal, N., & Narang, S. B. (2020). X-band microwave analysis and characterization of zinc substituted nickel ferrites prepared by sol–gel citrate route. *Journal of Electronic Materials*, 49(1), 668–680. <https://doi.org/10.1007/s11664-019-07694-6>
- Ali, R., Khan, M. A., Manzoor, A., Shahid, M., Haider, S., Malik, A. S., Sher, M., Shakir, I., & Farooq Warsi, M. (2017). Investigation of structural and magnetic properties of Zr-Co doped nickel ferrite nanomaterials. *Journal of Magnetism and Magnetic Materials*, 429, 142–147. <https://doi.org/10.1016/j.jmmm.2017.01.007>
- Amiri, G., Abolhasani, M. R., & Keshavarz, H. (2010). Radar absorption of Ni_{0.7}Zn_{0.3}Fe₂O₄ nanoparticles. September 2018, 7–14.
- Anitasari, R. (2024). Sintesis Dan Karakterisasi Komposit E-A-Zrp/Pani/Pp Sebagai Material Penyerap Gelombang Radar. The Republic of Indonesia Defense University.
- Apit, M., & Bura, R. O. (2020). Nickel ferrite/chitosan composite as a radar absorbing material on missile: A review and prospective. *AIP Conference Proceedings*, 2284(October). <https://doi.org/10.1063/5.0029318>
- Bakare, B. I., Ajaegbu, M., Bakare, B., Ajaegbu, M., & Idigo, V. (2022). A comprehensive review of radar system technology. *Quest Journals Journal of Electronics and Communication Engineering Research*, 8(8), 2321–5941. www.questjournals.org
- Cao, M. S., Cai, Y. Z., He, P., Shu, J. C., Cao, W. Q., & Yuan, J. (2019). 2D MXenes: Electromagnetic property for microwave absorption and electromagnetic interference shielding. *Chemical Engineering Journal*, 359, 1265–1302. <https://doi.org/10.1016/j.cej.2018.11.051>
- Chan, Y. L., You, K. Y., Mayzan, M. Z. H., Jusoh, M. A., Abbas, Z., & Esa, F. (2020). Investigation into return loss characteristic of graphene oxide/zinc ferrite/epoxy composite at x-band frequency. *Journal of Applied Science and Engineering*, 23(4), 593–602. [https://doi.org/10.6180/jase.202012_23\(4\).0003](https://doi.org/10.6180/jase.202012_23(4).0003)
- Choudhary, M., Witcomb, M. J., & Mallick, K. (2014). In situ generation of a high-performance Pd-polypyrrole composite with multi-functional catalytic properties. *Dalton Transactions*, 43, 6396–6405. <https://doi.org/10.1039/c3dt53567c>
- Derakhshani, M., Taheri-Nassaj, E., Jazirehpour, M., & Masoudpanah, S. M. (2021). Structural, magnetic, and gigahertz-range electromagnetic wave

- absorption properties of bulk Ni–Zn ferrite. *Scientific Reports*, 11(1), 1–13. <https://doi.org/10.1038/s41598-021-88930-0>
- Dey, B., Manoharan, C., Venkateshwarlu, M., Pawar, C. S., & Sagadevan, S. (2024). Exploring the effect of zinc substitution in nanocrystalline nickel ferrite for enhanced supercapacitor and gas sensing applications. *Ceramics International*, 50(7), 12121–12135. <https://doi.org/10.1016/j.ceramint.2024.01.116>
- Dhole, V. V. (2016). Structural and microstructural study of zirconium (Zr⁴⁺) doped nickel ferrite (NiFe₂O₄) nanoparticles. *International Advanced Research Journal in Science, Engineering, and Technology*, 3(9), 2393–2395. <https://doi.org/10.17148/IARJSET.2016.3914>
- Dudhal, R. D., Patade, S., Andhare, D., Paralikar, R., Chilwar, R., & More, S. D. (2020). Influence of fuel to metal nitrate ratio on the structural properties of nickel ferrite. *Journal of Physics: Conference Series*, 1644(1). <https://doi.org/10.1088/1742-6596/1644/1/012011>
- Gu, Q., Jafarian, M., Salman Seyyed Afghahi, S., Atassi, Y., & Al-Qassar, R. (2020). Optimizing impedance matching characteristics of microwave absorbing paint in the X-band using copper particles and polypyrrole coating. *Materials Research Bulletin*, 125(December 2019), 110780. <https://doi.org/10.1016/j.materresbull.2020.110780>
- Habibi, M. H., & Fakhri, F. (2017). Low-temperature preparation, characterization, magnetic measurements, thermal, optical, morphological, and photocatalytic properties of nano-size single-phase nickel ferrite NiFe₂O₄. *Journal of Materials Science: Materials in Electronics*, 28(18), 13455–13463. <https://doi.org/10.1007/s10854-017-7184-z>
- Hao, L., Dong, C., Zhang, L., Zhu, K., & Yu, D. (2022). Polypyrrole nanomaterials: Structure, preparation, and application. *Polymers*, 14(5139). <https://doi.org/10.3390/polym14235139>
- Iranmanesh, P., Tabatabai Yazdi, S., Mehran, M., & Saeednia, S. (2018). Superior magnetic properties of Ni ferrite nanoparticles synthesized by capping agent-free one-step coprecipitation route at different pH values. *Journal of Magnetism and Magnetic Materials*, 449, 172–179. <https://doi.org/10.1016/j.jmmm.2017.10.040>
- Katsuma, D., Khoo, P. L., Kobayashi, M., Shinagawa, T., & Izaki, M. (2022). Structural and Magnetic Characteristics of Hematite and Magnetite Films Prepared by Electrodeposition and Heating. *Journal of The Electrochemical Society*, 169(4), 042501. <https://doi.org/10.1149/1945-7111/ac6247>
- Kavitha, S., & Kurian, M. (2019). Effect of zirconium doping in the microstructure, magnetic and dielectric properties of cobalt ferrite nanoparticles. *Journal of Alloys and Compounds*, 799, 147–159.

<https://doi.org/10.1016/j.jallcom.2019.05.183>

- Khalil, H. F., Elsharkawy, S. G., & Al-harby, N. F. (2024). Dielectric and Magnetic Properties for Microwave Applications. 1–14.
- Khan, K., & Rehman, S. (2014). Microwave absorbance properties of zirconium-manganese substituted cobalt nanoferrite as electromagnetic (EM) wave absorbers. *Materials Research Bulletin*, 50, 454–461. <https://doi.org/10.1016/j.materresbull.2013.11.018>
- Kostishin, V. G., Isaev, I. M., & Salogub, D. V. (2024). Radio-absorbing magnetic polymer composites based on spinel ferrites: A review. *Polymers*, 16(7). <https://doi.org/10.3390/polym16071003>
- Li, J., Zhou, D., Wang, P. J., Du, C., Liu, W. F., Su, J. Z., Pang, L. X., Cao, M. S., & Kong, L. B. (2021). Recent progress in two-dimensional materials for microwave absorption applications. *Chemical Engineering Journal*, 425. <https://doi.org/10.1016/j.cej.2021.131558>
- Li, L. Z., Zhong, X. X., Wang, R., & Tu, X. Q. (2017). Structural, magnetic and electrical properties of Zr-substituted NiZnCo ferrite nanopowders. *Journal of Magnetism and Magnetic Materials*, 435, 58–63. <https://doi.org/10.1016/j.jmmm.2017.03.073>
- Li, S., Pan, J., Gao, F., Zeng, D., Qin, F., He, C., Doddiba, G., Wei, Y., & Fujita, T. (2021). Structure and magnetic properties of coprecipitated nickel-zinc ferrite-doped rare earth elements of Sc, Dy, and Gd. *Journal of Materials Science: Materials in Electronics*, 32(10), 13511–13526. <https://doi.org/10.1007/s10854-021-05928-0>
- Liu, S., Yu, B., Wang, S., Shen, Y., & Cong, H. (2020). Preparation, surface functionalization and application of Fe₃O₄ magnetic nanoparticles. *Advances in Colloid and Interface Science*, 281, 102165. <https://doi.org/10.1016/j.cis.2020.102165>
- Lu, H., Li, X., & Lei, Q. (2021). Conjugated conductive polymer materials and its applications: A mini-review. *Frontiers in Chemistry*, 9(September), 6–11. <https://doi.org/10.3389/fchem.2021.732132>
- Malere, C. P. R., Donati, B., Eras, N., Silva, V. A., & Lona, L. F. (2022). Electromagnetic evaluation of radar absorbing materials based on conducting polypyrrole and organic–inorganic nanocomposite of polypyrrole/kaolinite. *Journal of Applied Polymer Science*, 139(17). <https://doi.org/10.1002/app.52023>
- Micheli, D., Pastore, R., Vricella, A., Delfini, A., Marchetti, M., & Santoni, F. (2017). Electromagnetic characterization of materials by vector network analyzer experimental setup. In *Spectroscopic Methods for Nanomaterials Characterization* (Vol. 2). <https://doi.org/10.1016/B978-0-323-46140-5.00009-1>
- Mishra, M. (2023). Polypyrrole : Properties and application. In *Encyclopedia of*

- Polymer Applications (pp. 2902–2103).
<https://doi.org/10.4324/9781351019422-140000377>
- Moučka, R., Sedláčik, M., Prokeš, J., Kasparyan, H., Valtera, S., & Kopecký, D. (2020). Electromagnetic interference shielding of polypyrrole nanostructures. *Synthetic Metals*, 269(June).
<https://doi.org/10.1016/j.synthmet.2020.116573>
- Narang, S. B., & Pubby, K. (2020). Nickel Spinel Ferrites : A Review. *Journal of Magnetism and Magnetic Materials*, 167163.
<https://doi.org/10.1016/j.jmmm.2020.167163>
- Prasojo, A. E. (2024). Synthesis And Application of Core-Shell $\text{Fe}_{2.75}\text{Ni}_{0.25}\text{O}_4@\text{SnO}_2$ Nanocomposite As Radar Electromagnetic Waves Absorber Toward Stealth Technology. The Republic of Indonesia Defense University.
- Putri, G. P., Triyono, E., S., B. B., Hasan, A., Widodo, S., & Suhendro. (2019). Pengaruh Penggunaan Komposit-Rami sebagai Penyerap Gelombang Radar Pada Stealth Technology. *Seminar Nasional Sains Teknologi Dan Inovasi Indonesia*, 1(1), 49–56.
- Putri, R. (2024). Development Of Radar Absorbing Materials (Ram) In Military Equipment Based On ZnO/Polyaniline/Epoxy Paint Nanocomposites. The Republic of Indonesia Defense University.
- Rus, S. F., Vlazan, P., & Herklotz, A. (2016). Synthesis and characterization of zirconium substituted cobalt ferrite nanopowders. *Journal of Nanoscience and Nanotechnology*, 16(1), 851–855.
<https://doi.org/10.1166/jnn.2016.11775>
- Rybicki, T., Stempień, Z., & Karbownik, I. (2021). EMI shielding and absorption of electroconductive textiles with PANI and PPy conductive polymers and numerical model approach. *Energies*, 14(22).
<https://doi.org/10.3390/en14227746>
- Sajjan, S., Kulkarni, A., & Gounhalli, S. G. (2024). Influence of zirconium substitution on electrical properties of nickel-zinc ferrites. *IOP Conference Series: Materials Science and Engineering*, 1300(1), 012032.
<https://doi.org/10.1088/1757-899x/1300/1/012032>
- Salih, S. J., & Mahmood, W. M. (2023). Review on magnetic spinel ferrite (MFe_2O_4) nanoparticles: From synthesis to application. *Heliyon*, 9(6), e16601. <https://doi.org/10.1016/j.heliyon.2023.e16601>
- Sangsuriyonk, K., Paradee, N., Rotjanasuworapong, K., & Sirivat, A. (2022). Synthesis and characterization of $\text{CoFe}_{1-x}\text{Fe}_2\text{O}_4$ nanoparticles by anionic, cationic, and non-ionic surfactant templates via co-precipitation. *Scientific Reports*, 12(1), 1–11. <https://doi.org/10.1038/s41598-022-08709-9>
- Sarkar, N. N., Rewatkar, K. G., Nanoti, V. M., & Tayade, N. T. (2018).

- Structural, magnetic-electrical behavior of Zr substituted Ni-Zn spinel ferrite. *Research Journal of Science and Technology*, 10(1), 13. <https://doi.org/10.5958/2349-2988.2018.00003.7>
- Shahzad, F., Alhabeb, M., Hatter, C. B., Anasori, B., Hong, S. M., Koo, C. M., & Gogotsi, Y. (2016). Electromagnetic interference shielding with 2D transition metal carbides (MXenes). *Science*, 353(6304), 1137–1140. <http://science.sciencemag.org/>
- Sulistiyo, H., Fakhruddin Farhan, M., Soraya, N. A., & Gunadi, G. I. (2022). Material lapisan anti-radar untuk menyamarkan kawasan strategis dan sarana pendukung militer (Markas TNI, hanggar pesawat tempur, hanggar tank, dan gudang amunisi). *Jurnal Kewarganegaraan*, 6(4).
- Taryana, Y., Manaf, A., Sudrajat, N., & Wahyu, Y. (2019). Material Penyerap Gelombang Elektromagnetik Jangkauan Frekuensi Radar. *Jurnal Keramik Dan Gelas Indonesia*, 28(1), 1–29.
- Teber, A., & Sarac, M. F. (2023). Electrical, magnetic, microstructural, and characteristic properties of zirconium-substituted $\text{Co}_{0.5}\text{Ni}_{0.5}\text{Zr}_x\text{Fe}_{2-x}\text{O}_4$ spinel ferrite nanostructures. *Arabian Journal for Science and Engineering*, 48(6), 8153–8164. <https://doi.org/10.1007/s13369-023-07607-0>
- Thines, K. R., Abdullah, E. C., Mubarak, N. M., & Ruthiraan, M. (2017). In-situ polymerization of magnetic biochar–polypyrrole composite: A novel application in supercapacitor. *Biomass and Bioenergy*, 98, 95–111. <https://doi.org/10.1016/j.biombioe.2017.01.019>
- Thomas, P., Abdulhakim, L. V., Pushkaran, N. K., & Karuvandi, A. C. (2020). Wideband radar absorbing structure using polyaniline-graphene nanocomposite. *C*, 6(4), 72. <https://doi.org/10.3390/c6040072>
- Vara Prasad, B. B. V. S., Ramesh, K. V., & Srinivas, A. (2017). Structural and Magnetic Studies of Nano-crystalline Ferrites MFe_2O_4 (M = Zn, Ni, Cu, and Co) Synthesized Via Citrate Gel Autocombustion Method. *Journal of Superconductivity and Novel Magnetism*, 30(12), 3523–3535. <https://doi.org/10.1007/s10948-017-4153-y>
- Velmurugana, K., Venkatachalapathy, V. S. K., & Sendhilnathanc, S. (2010). Synthesis of nickel zinc iron nanoparticles by coprecipitation technique. *Materials Research*, 13(3), 299–303. <https://doi.org/10.1590/s1516-14392010000300005>
- Wang, Z., Cheng, Z., Xie, L., Hou, X., & Fang, C. (2021). Flexible and lightweight $\text{Ti}_3\text{C}_2\text{T}_x$ MXene/ Fe_3O_4 @PANI composite films for high-performance electromagnetic interference shielding. *Ceramics International*, 47(4), 5747–5757. <https://doi.org/10.1016/j.ceramint.2020.10.161>
- Wardiyati, S., Ari Adi, W., Didin Sahidin Winatapura Pusat Sains dan Teknologi Bahan Maju, D., Puspipstek, K., & Selatan, T. (2018). Sintesis dan

- karakterisasi microwave absorbing material berbasis Ni-SiO₂ dengan metode sol-gel. In *Jurnal Fisika* (Vol. 8, Issue 2).
- Yadav, P., Faujdar, A., Gayathri, S., & Kalainathan, S. (2014). A study on nickel substituted zirconium ferrite nanoparticles prepared by coprecipitation route. *International Journal of ChemTech Research*, 6(3), 2181–2183.
- Yang, H., Ye, T., Lin, Y., & Liu, M. (2015). Excellent microwave absorption property of ternary composite: Polyaniline-BaFe₁₂O₁₉-CoFe₂O₄ powders. *Journal of Alloys and Compounds*, 653, 135–139. <https://doi.org/10.1016/j.jallcom.2015.08.272>
- Yussuf, A., Al-Saleh, M., Al-Enezi, S., & Abraham, G. (2018). Synthesis and characterization of conductive polypyrrole: The influence of the oxidants and monomer on the electrical, thermal, and morphological properties. *International Journal of Polymer Science*, 2018. <https://doi.org/10.1155/2018/4191747>
- Zayan, S., Elshazly, A., & Elkady, M. (2020). In situ polymerization of polypyrrole @ aluminum fumarate metal-organic framework hybrid nanocomposites for the application of wastewater treatment. *Polymers*, 12(8). <https://doi.org/10.3390/polym12081764>
- Zhang, Z., Cai, Z., Zhang, Y., Peng, Y., Wang, Z., Xia, L., Ma, S., Yin, Z., Wang, R., Cao, Y., Li, Z., & Huang, Y. (2021). The recent progress of MXene-based microwave absorption materials. *Carbon*, 174, 484–499. <https://doi.org/10.1016/j.carbon.2020.12.060>
- Zong, M., Huang, Y., Ding, X., Zhang, N., Qu, C., & Wang, Y. (2014). One-step hydrothermal synthesis and microwave electromagnetic properties of RGO/NiFe₂O₄ composite. *Ceramics International*, 40(5), 6821–6828. <https://doi.org/10.1016/j.ceramint.2013.11.145>