

high temperature 200 °C. The measured and simulated parameters confirm the validity of theoretical electromagnetic model with good agreement.

REFERENCES

- [1] Tahar, M., Abdechafik, H., Mecheri, K. (2018). Modelling and measurement of electromagnetic shielding effectiveness. In: 2018 International Conference on Electrical Sciences and Technologies in Maghreb (CISTEM). IEEE, 2018. pp. 1-6. <https://doi.org/10.1109/CISTEM.2018.8613459>
- [2] Merizgui, T., Hadjadj, A., Kiouss, M., Gaoui, B. (2019). Effect of human body temperature on new multilayer composite shield in pacemaker. Revue des Composites et des Matériaux Avancés, 29(1): 27-32. <https://doi.org/10.18280/rcma.290105>
- [3] Shen, B., Zhai, W., Tao, M., Ling, J., Zheng, W. (2013). Lightweight, multifunctional polyetherimide/graphene@ Fe_3O_4 composite foams for shielding of electromagnetic pollution. ACS Applied Materials & Interfaces, 5(21): 11383-11391. <https://doi.org/10.1021/am4036527>
- [4] Shen, B., Li, Y., Zhai, W., Zheng, W. (2016). Compressible graphene-coated polymer foams with ultralow density for adjustable electromagnetic interference (EMI) shielding. ACS Applied Materials & Interfaces, 8(12): 8050-8057. <https://doi.org/10.1021/acsmami.5b11715>
- [5] Merizgui, T., Hadjadj, A., Kiouss, M., VR, A.P., Gaoui, B. (2018). Effect of magnetic iron (III) oxide particle addition with MWCNTs in kenaf fibre-reinforced epoxy composite shielding material in ‘E’, ‘F’, ‘I’ and ‘J’ band microwave frequencies. Materials Research Express, 2018. <https://doi.org/10.1088/2053-1591/aaf9de>
- [6] Merizgui, T., Hadjadj, A., Gaoui, B., Kiouss, M. (2018). Effect of temperature on the electromagnetic characteristic behavior of copper. In: 2018 International Conference on Applied Smart Systems (ICASS). IEEE, 2018. pp. 1-5. <https://doi.org/10.1109/ICASS.2018.8652063>
- [7] Singh, B.P., Choudhary, V., Saini, P., Pande, S., Singh, V.N., Mathur, R.B. (2013). Enhanced microwave shielding and mechanical properties of high loading MWCNT-epoxy composites. Journal of Nanoparticle Research, 15(4): 1554. <https://doi.org/10.1007/s11051-013-1554-0>
- [8] Belaabed, B., Wojkiewicz, J.L., Lamouri, S., El Kamchi, N., Lasri, T. (2012). Synthesis and characterization of hybrid conducting composites based on polyaniline/magnetite fillers with improved microwave absorption properties. Journal of Alloys and Compounds, 527: 137-144. <https://doi.org/10.1016/j.jallcom.2012.02.179>
- [9] Kuzhir, P., Paddubskaya, A., Plyushch, A., Volynets, N., Maksimenko, S., Macutkevic, J., Celzard, A. (2013). Epoxy composites filled with high surface area-carbon fillers: Optimization of electromagnetic shielding, electrical, mechanical, and thermal properties. Journal of Applied Physics, 114(16): 164304. <https://doi.org/10.1063/1.4826529>
- [10] Al-Ghamdi, A.A., Al-Hartomy, O.A., Al-Solamy, F., Al-Ghamdi, A.A., El-Tantawy, F. (2013). Electromagnetic wave shielding and microwave absorbing properties of hybrid epoxy resin/foliated graphite nanocomposites. Journal of Applied Polymer Science, 127(3): 2227-2234. <https://doi.org/10.1002/app.37904>
- [11] Cao, M.S., Yang, J., Song, W.L., Zhang, D.Q., Wen, B., Jin, H.B., Yuan, J. (2012). Ferroferric oxide/multiwalled carbon nanotube vs polyaniline/ferroferric oxide/multiwalled carbon nanotube multiheterostructures for highly effective microwave absorption. ACS Applied Materials & Interfaces, 4(12): 6949-6956. <https://doi.org/10.1021/am3021069>
- [12] Merizgui, T., Hadjadj, A., Gaoui, B., Kiouss, M. (2018). Comparison electromagnetic shielding effectiveness between smart multilayer arrangement shields. In: 2018 International Conference on Applied Smart Systems (ICASS). IEEE, 2018. pp. 1-5. <https://doi.org/10.1109/ICASS.2018.8651965>

NOMENCLATURE

EMI	Electromagnetic interference
SE	Shielding effectiveness
PMC	Polymer composite

Greek symbols

σ	Electrical conductivity
μ	Magnetic permeability
ϵ	Electrical permittivity

Subscripts

T	temperature
CNT	Carbon nano-tube
NC	Nanocomposite