**Flexible, printed absorbers for shielding against microwave radiation**

E. Gagaoudakis1,\*, E. Mantsiou2, C.-P. Tsichlis1,2, M. Zografaki1,2, K. Dovelos3, A. Paraskevopoulos4, V. Vardakastani3, D. Tzarouchis3, M. Koutsoupidou3, P. Kosmas3, C. Spandonidis5, F. Giannopoulos5, A. Petsa5, V. Binas1,2,\*

*1Institute of Electronic Structure and Laser (IESL), Foundation of Research and Technology-Hellas (FORTH), Heraklion Crete, Greece*

*2Department of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece*

*3Meta Metamaterials Europe, Ap. Pavlou 10, 15123, Marousi, Athens, Greece*

*4Institute of Informatics and Telecommunications, NCSR Demokritos, 15310 Athens, Greece*

*5Prisma Electronics SA, 87 Dimokratias Ave., 68100, Alexandroupolis, Greece*

*\*corresponding authors:* *mgagas@iesl.forth.gr**, binasbill@iesl.forth.gr*

Absorbers in microwave region of the electromagnetic spectrum are of great importance, due to their application as protective coatings against this radiation. Moreover, Perfect Metamaterials Absorbers (PMAs) have attracted much research attention during the last decade as they are able to fully absorb the microwave radiation. The PMAs are based mainly on periodic metallic structures with both specific periodicity and geometry.

In the present work, the properties of conductive inks, as well as of the substrates were investigated, in order to fabricate PMAs based on printed metallic periodic structures. More specific, nanoinks based on Ag or other metals were examined as far as their morphology, viscosity, resistance etc. concern, while flexible substrates such as kapton and textiles were characterized and tested for their ability to print metallic structures on them. Finally, different geometries and sizes were tested to be printed on the substrates, according to simulations that have been done.

Moreover, the metallic periodic structures fabricated by 3D printing technique on flexible substrates as well as on textiles, were investigated as perfect absorbers for electromagnetic waves in the microwave region of 9 GHz to 14 GHz. Specifically, various topologies were designed, simulated, and developed to control surface impedance and achieve electromagnetic absorption at microwave region. The level of transmission and reflection of the developed samples was measured with appropriate waveguides. From these, the absorption was calculated and found to be enhanced for these printed periodic metallic structures between 9 and 10.5 GHz, indicating a possible perfect absorber in the microwave region of EM radiation.

**Acknowledgements**

This work was supported by the “Metamaterial Products to Protect from Electromagnetic Radiation - PROPILEA” project with ID 16971 - OPS TA 5149205 funded by Greece 2.0 - National Recovery and Resilience Plan funded by the European Union – NextGenerationEU.