Secteur des Sciences et Technologies

Invitation à la soutenance publique de thèse de

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Master en Sciences chimiques à finalité approfondie
Master en Conservation et Restauration des Œuvres d'Art

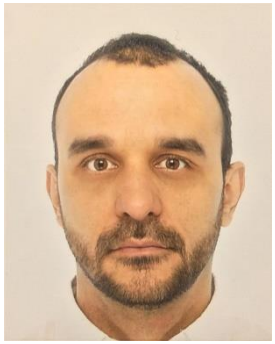
Pour l'obtention du grade de Docteur en sciences

« Decoration of nanocarbon supports with magnetic nanoparticles for the control of electromagnetic propagation »

qui se déroulera
le vendredi 20 décembre 2019 à 14h
Salle Shannon – Bâtiment Maxwell
Place du Levant, 3
1348 Louvain-la-Neuve

Jury members :

Prof. Sophie Hermans (UCLouvain), supervisor
Prof. Isabelle Huynen (UCLouvain), supervisor
Prof. Jacques Devaux (UCLouvain), chairperson
Prof. Arnaud Delcorte (UCLouvain), secretary
Prof. Jean-Pierre Raskin (UCLouvain)
Prof. Carla Bittencourt (UMons, Belgium)
Prof. Véronique Dupuis (Université Lyon, France)



Wireless data communication via electromagnetic (EM) transmission in the low-power microwave range (2 to 40 GHz) is ubiquitous. Its extensive use in everyday life has led to growing concern about device malfunctioning due to EM interference, possible threats to human health or transmitted data security, among other issues. Consequently, highly efficient EM shielding is increasingly becoming necessary, being already a legal requirement in some countries. Classical EM shielding solutions, based on EM reflectors, are now considered unsatisfactory given that they simply deflect the unwanted signal, shifting the problem elsewhere. Thus, it is currently considered that broadband microwave absorption materials are the best possible solution.

In this study, a new series of metamaterial microwave absorber nanocomposites were prepared by decorating nanocarbon supports (NcS) with ferro- and ferrimagnetic nanoparticles (MNPs). The employed synthetic techniques were finely tuned as to purposely vary the deposited MNPs composition, size, loading rate and spatial distribution over the NcS as well as the oxidation state of the latter. A novel nanopowder EM-characterization technique was also developed to study the impact of these physicochemical variations on the nanocomposites ability to modify microwave propagation. It was thus proven that certain well-known physical phenomena, such as the ferromagnetic resonance (FMR) of the MNPs and the conductivity of the NcS, can be exploited to induce absorption losses in the microwave range.

Some of the nanocomposites produced in this study were also employed to design and fabricate two novel microwave absorber material (MAM) prototypes. On the one hand, flexible, thin films were prepared by dispersing the chosen nanocomposites into a polycarbonate matrix. On the other hand, two types of water-based inks were formulated and a series of planar frequency-selective-surfaces (FSS) were inkjet-printed onto a polycarbonate substrate. The prototypes efficiency as ultra-wideband MAMs was evaluated, paving the way towards novel EM shielding functionalities.