Multiscale electromagnetic characterization of nanomaterials: from state of the Art to sub-systems implementation

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ABSTRACT

Nanomaterials have been extensively studied during the recent years due to their exceptional electrical, thermal and mechanical properties. Combined to these properties, their exploitation in the microwave domain appear also as a very important application field as numerous research activities have been devoted to radio frequency (RF) resonators, field-effect transistors (CNT-FETs) in complement to chemical and mechanical sensors development. In this framework, electromagnetic properties knowledge of individual nanomaterials extended to bundles configuration in a wide frequency band is the key to understand and design new components for future implementation in next generation of miniaturized microwave systems. Because of growth technology constraints and compatibility with standard technologies, State-of-the-Art in nanomaterials electromagnetic modeling and characterization methods are restricted to 3D electromagnetic modelling tools of collective planar or vertical layers or oriented/disoriented nanomaterials for implementation in commercial softwares, and to principles and techniques of permittivity measurements using dedicated planar or coaxial transmission lines test structures for determination of bulk material permittivity, permeability and conductivity in frequency domain.

Multiscale modeling and design tools implementing material anisotropic parameters from atomic configuration up to mesoscale, in complement with multiscale microwave characterization under probe test environment in a large frequency bandwidth opens routes to new microwave signal processing functionalities such as switching, generation, amplification and emission over a large frequency bandwidth.

This presentation will summarize latest microwave functionalities demonstrations of 1D and 2D materials from their electromagnetic properties extractions for high frequency applications with a specific focus on latest demonstrations for airborne applications.

BIOGRAPHY

Charlotte Tripon-Canseliet received the Ph.D. degree in 2003 within Pierre and Marie Curie University (UPMC) in Paris. Since 2003, she has been working on the evolution of devices in RF domain and technologies at national and international level, as postdoctoral research scientist at UPMC, in cooperation with Thales. She is now Associate Professor at UPMC since 2007. Her expertise concerns the elaboration of models of light/matter interactions with interface with design of RF integrated devices and RF-integrated devices characterizations in the Instrumentation group at ESPCI/LPEM. Her scientific expertise covers the areas of microwave nano devices, two-dimensional materials, light matter interactions at nanoscale. Charlotte Tripon-Canseliet has a strong expertise as coordinator of national projects in France and participates to European and bi-lateral international projects.