The faculty of Engineering of the Vrije Universiteit Brussel and the Department of School of Information science and technology of the Northwest University invite you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES (VUB)

DOCTOR IN ENGINEERING (NWU)

of **Cheng Chen**

The public defense will take place on **Thursday 27th June 2024 at 9:30am** in room **D.2.01** (Building **D,** VUB Main Campus)

To join the digital defense, please click here
MeetingID: 322 934 514 827
Passcode: kJaUED

NOVEL FABRICATION AND ELECTROMAGNETIC-OPTICAL CHARACTERIZATION TECHNIQUES OF CARBON-BASED NANOSTRUCTURES

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Abstract of the PhD research

Nowadays, carbon nanomaterials are increasingly garnering attention as the next generation of semiconductor materials. Notably, graphene and carbon nanofibers (CNFs) have emerged as pivotal players in the semiconductor domain, owing to their remarkable electrical, mechanical, and thermal properties, coupled with their distinctive structural attributes.

Graphene, characterized by its two-dimensional single-layer structure of densely packed carbon atoms, boasts unparalleled electrical conductivity. This positions it for significant potential in applications like high-frequency electronic devices and sensors. Furthermore, its transparency and flexibility pave the way for innovative advancements in flexible electronic devices and display technologies, rejuvenating the electronics industry's potential. CNFs, celebrated for their nanoscale diameter and exceptional mechanical attributes, carve a niche for themselves in material science. Their superior conductivity heralds vast opportunities, especially in realms such as conductive fibers and flexible circuitry. Within the spectrum of synthesis techniques, Chemical Vapor Deposition (CVD) emerges as a standout method, particularly for producing high-quality graphene films and CNFs.

This dissertation delves into the CVD preparation, performance characterization, and subsequent applications of these materials, particularly in electromagnetic (EM) and ultraviolet (UV) optics. Specifically, the research encompasses:

1. Investigating the photoluminescence (PL) performance of ZnO/graphene composite films and ZnO@CNFs composite fibers within the UV emission spectrum
2. Determining the optimal thickness of ZnO in the ZnO/graphene composite for optimal UV-PL behavior
3. Analyzing the anisotropic EM loss behavior of CNFs and ZnO@CNFs samples across the MMW and sub-terahertz bands
4. Pioneering a novel quality-assessment method for wafer-scale CVD-prepared graphene films, grounded in their distinctive interactions with terahertz TE10 waves

In essence, this research centers on graphene and CNFs, exploring their potential in the realm of EM and UV optics and offering insights based on their intrinsic properties.