Université Lille Nord de France
Pôle de Recherche et d'Enseignement Supérieur

Ecole doctorale régionale Sciences Pour l'Ingénieur
Lille Nord-de-France - 072

Titre Thèse	**Teraherz optical activity for biomedical applications (cotutelle)**	
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Laboratoire	**IEMN, Université Lille & Nanotechnology Centre, VSB-Technical University of Ostrava, Czech Republic**	Web :www.iemn.fr https://cnt.vsb.cz/en
Equipe	**THz Photonics**	Web :
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Résumé du sujet :

The main target of the thesis is to extend terahertz time-domain spectroscopy (THz-TDS) to precisely measure THz optical activity (circular birefrigence and dichroism) and apply it to biomedical sensing. First the high sensitivity ellipsometric technique to measure the THz optical activity will be developed and tested. Then the method will be applied to characterize optically active chiral structures - artificial gyrotropic structures prepared by lithography and natural chiral polymers (sacharides, proteins, lysozymes, RNA, etc.).

Terahertz (THz) spectral range of electromagnetic radiation (frequency range from 0.1 to 5 THz, wavelength range from 60 m to 3 mm) recently attracts a huge interest due to development of efficient THz sources and wide applications in security inspection, biomedicine, wireless high-speed communications, and detection of dangerous materials and gases. In the area of biological and medical applications, the THz radiation is applied to detect either water concentration or low frequency vibration of heavy molecules. Typical biomedical molecules (sacharides, proteins, lysozymes, biopolymers, RNA, DNA, etc.) exhibit reduced symmetry and chirality, which enable selective sensitivity on them using circular polarization techniques. Sensing in THz spectral range is often based on the terahertz time-domain spectrometry (THz-TDS), which gives several advantages as increased sensitivity based on ultrashort-pulsed laser, measurement of the complex spectroscopic response, or possibility to measure fast dynamic processes. The polarization sensitive analysis as ellipsometry or Mueller matrix polarimetry enables to measure polarization rotation, circular birefrigence and dichroism having enormous potential for sensitivity on biomedical chiral molecules. Special consideration will be devoted to time-domain Raman spectroscopy and THz Raman optical activity.

This PhD research is co-funded by the Nanotechnology Center in Ostrava, Czech Republic. Part of the research will be conducted in Czech Republic. The candidate will have to be willing to spend several months (at least 4) per year in Czech Republic.

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