PRE DOCTORAL RESEARCHER ON CORRELATIVE IR/RAMAN NANOSPECTROSCOPY (COTUTELLE)

Company Description

The Nanoscience Cooperative Research Center, CIC nanoGUNE, located in Donostia / San Sebastian, Basque Country (Spain), is currently looking for a Pre Doctoral Researcher on Correlative IR/Raman Nanospectroscopy (cotutelle between the Nanooptics Group of the Basque Nanoscience Cooperative Research Center, San Sebastián and the Molecular Spectroscopy Group of the Institut des Sciences Moléculaires, Bordeaux). Optical microscopy coupled to spectroscopic techniques allows structural and chemical information to be obtained with a spatial resolution limited by diffraction to a few hundreds of nanometres or a few microns. Such a resolution is insufficient to describe the nanoscale heterogeneity of nanomaterials and molecular mechanisms at their surface. To overcome this limit, IR and Raman nanospectroscopies have been separately developed for two decades. These techniques combine a scanning probe microscope (SPM), such as an atomic force microscope (AFM), and an optical spectrometer (either a FTIR or Raman spectrometer). Therefore, they gather the advantages of both parts, namely the high spatial resolution of SPM instruments and the high chemical and structural specificity of FTIR/Raman ones. However, little studies have been carried out using both IR and Raman spectroscopies to investigate the same sample, and none of them have been performed in a colocalized fashion

Information

Deadline: 2024-08-31
Country: Basque Country
Category: Academia
City: Donostia-San Sebastián
Province: Gipuzkoa

Company

CIC nanoGUNE

Main functions, requisites & benefits

Main functions

Optical microscopy coupled to spectroscopic techniques allows structural and chemical information to be obtained with a spatial resolution limited by diffraction to a few hundreds of nanometres or a few microns. Such a resolution is insufficient to describe the nanoscale heterogeneity of nanomaterials and molecular mechanisms at their surface. To overcome this limit, IR and Raman nanospectroscopies have been separately developed for two decades. These techniques combine a scanning probe microscope (SPM), such as an atomic force microscope (AFM), and an optical spectrometer (either a FTIR or Raman spectrometer). Therefore, they gather the advantages of both parts, namely the high spatial resolution of SPM instruments and the high chemical and structural specificity of FTIR/Raman ones. However, little studies have been carried out using both IR and Raman spectroscopies to investigate the same sample, and none of them have been performed in a colocalized fashion, i.e. using a single system allowing for IR and Raman nanospectroscopic measurements. The 3-4 years PhD Project will focus in the instrumental development of correlative IR/Raman nanospectroscopy to demonstrate the capability of this technique to obtain nanoscale co-localized IR/Raman spectra on various samples including 2D materials as test samples. The project will involve periods in both the Molecular Spectroscopy Group of the Institut des Sciences Moléculaires (University of Bordeaux, Talence, France), under the supervision of Dr. Sébastien Bonhommeau (SB), and in the Nanooptics Group of the Nanoscience Research Center CIC nanoGUNE (San Sebastián, Basque Country, Spain), under the supervision of Prof. Rainer Hillenbrand (RH). SB is an expert in Raman nanospectroscopy, also called tip-enhanced Raman spectroscopy, especially for the study of biomolecules [1-4]. RH is a renowned expert in IR nanospectroscopy. His group pioneered the development of scattering-type scanning near-field optical microscopy (s-SNOM) and FTIR nanospectroscopy (nano-FTIR) [5,6]. His research did not only set the scientific and technological foundations of s-SNOM and nano-FTIR, but also demonstrated its enormous application potential in widely different fields of science and technology, such as for nanoscale conductivity mapping in devices, nanoscale chemical identification of organic and inorganic materials, bioimaging and mapping exotic light waves in 2D and quantum materials [7,8]. References: [1] S. Bonhommeau et al., Angew. Chem. Int. Ed. 2017, 56, 1771-1774. [2] D. Talaga et al., , Angew. Chem. Int. Ed. 2018, 57, 15738-15742. [3] D. Talaga et al., , J. Phys. Chem. Lett. 2020, 11, 3835-3840. [4] D. Talaga et al., , J. Phys. Chem. B 2022, 126, 5024-5032. [5] F. Huth et al., Nat. Mater. 2011, 2, 352-356. [6] F. Huth et al., Nano Lett. 2012, 12, 3973-3978. [7] P. Li et al., Science 2018, 359, 892-896. [8] A. Bylinkin et al., R, Nat. Photonics 2021, 15, 197-202.

Requisites

Applicants should hold an Internationally recognized Master Degree (or equivalent) in physical or related disciplines. They should show clear motivation and skills for experimental work, in particular for instrumental development of optical setup, programming and solid state physics. Experience in TERS and s-SNOM is not required, but it would be appreciated. The candidate must also be able to work independently, after an inevitable training period, and interact with different staff members. A good level in written and spoken English is a mandatory prerequisite