and allows a deeper insight into structural rearrangements during the first isomerization step.

3869-Pos

Effects of Hydration Levels on the Bandwidth of Microwave Resonant Absorption Induced by Confined Acoustic Vibrations

Tzu-Ming Liu, Hung-Pin Chen, Shih-Chia Yeh, Chih-Yu Wu, Chung-Hsiung Wang, Tang-Nian Luo, Yi-Jan Chen, Shen-Iuan Liu, Chi-Kuang Sun.
National Taiwan University, Taipei, Taiwan.

The vibration modes of molecules can be revealed by infrared absorption spectroscopy if their displacements change the dipole moments of molecules. Depending on the bonding strength, the mass of atoms, and the types of vibrations, the resonant absorption frequencies of molecules range from hundreds of terahertz (THz) to several THz. For collective vibrations of macromolecules like proteins or virions, the corresponding resonant frequencies will be around THz and could be probed by the THz or microwave absorption spectroscopy. However, in this frequency range, the periods of vibrations are close to or above the persistence time of hydrogen bonding of water molecules. If the surface to volume ratio of macromolecules is large, surrounding water molecules will overdamp the vibrations and smear the resonant absorption feature. Recently, we demonstrated that confined acoustic vibrations (CAV) of viruses can modify dipole moments and result in microwave resonant absorption (MRA) (Liu *et al.*, 2009). The resonant absorption frequencies correspond to those of dipolar active [SPH, l=1] modes. The activation of the resonant coupling relies on the core-shell charge structures, which are inherent on the capsid surfaces. Such characteristic absorption peak is rarely found in THz spectroscopy on solvated proteins and the actual mechanism worth a further investigation.

In this study, by decreasing the pH value of solution dwon to 5.2 or inactivating viruses, we enhanced the surface hydrophilicity and increased the magnitude of surface potentials. Both of these surface manipulations raised the surface affinity to water molecules, provide better acoustic confinements, and narrowed the bandwidths of CAV-induced MRA. Our results indicate that the viscoelastic transition of hydration shells play a critical role in the THz or microwave vibration spectroscopy.

T.-M. Liu *et al.*, *Appl. Phys. Lett.* **94**, 043902 (2009).

3870-Pos

Raman Spectroscopic Detection of an Optically Trapped Single DNA Molecule

Satish K. Rao, Saurabh Raj, Dmitri Petrov.
ICFO - The Institute of Photonic Sciences, Castelldefels, Spain.

Optical trapping has opened up a number of biophysical fields because of its ability to hold and manipulate single cells and molecules. In addition, the force sensitivity of an optical trap has allowed for a number of studies in to the mechanics of the most basic biological systems such as DNA. However, the majority of these experiments are based on a measured force correlated to a detected displacement or extension of the molecule in question. Due to the low optical cross section of a single DNA molecule, for example, interacting light directly with the structure, in order to obtain a detailed spectrum, has not been possible.

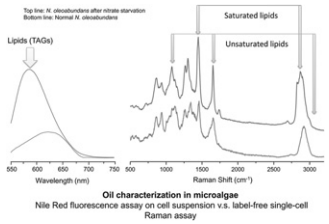
In this work, we present a measurement of a Raman spectrum from a single DNA molecule that is attached to two optically trapped dielectric microspheres. The scattering cross section in this instance is enhanced by the injection of nanosized silver colloids to the solution that adsorb on to the DNA. A near-infrared beam is used for excitation and Raman bands of DNA are obtained that agree with those from previous studies of DNA-metal colloid solutions. The presence of just one DNA molecule is verified by measuring the well-established force-extension curve. The adsorbed nanometer sized silver structures do not greatly affect the overall elasticity of the DNA, however the mechanical response at low to medium range forces seems to be altered. The addition of Raman spectroscopy to existing force spectroscopy methods could provide new information about the mechanochemical makeup of a structure through a correlation of the two methods.

3871-Pos

Single-Cell Diesel Mining on Microalgae: Direct and Quantitative Monitoring of Microalgal Oil Production In Vivo by Raman Spectroscopy

Huawen Wu, Joanne V. Volponi, Seema Singh.
Sandia National Laboratories, Livermore, CA, USA.

Microalgae, known for their rapid growth and high lipid content, became a promising candidate for the next generation feedstocks for liquid biofuels. Traditionally, instead of living organisms, they were treated as lifeless biomass in bulky, lyophilized or extracted forms, making it difficult to understand the fundamental biological processes in play. Labeling algae with fluorescent probes can be a potential high-throughput method but it provides little chemical information and is limited by impermeability, toxicity and specificity. In this work, we focus on in situ, in vivo and label-free Raman characterizations of single living green algae of several species. Our study has demonstrated that single-cell laser-trapping confocal Raman spectroscopy can directly obtain quantitative information of the lipids produced inside individual algae. Information critically related with the quality of derived biodiesel, such as lipid unsaturation and melting temperature can be obtained at single-cell level. Meanwhile, lipid triggering effect by nitrate starvation was characterized in vivo on single cells. Our real-time in vivo "diesel mining" on individual microalgae cells enables the possibility of researching and engineering of the best conditions and species for algal oil production.



Imaging & Optical Microscopy IV

3872-Pos

How to use Confocal Microscopy in Search of a Highly Resolved Hologram

Aura I. Moreno-Vega[1], Carlos Saldaña[2], Veronica Morales-Tlalpan[3], Mauricio Diaz-Muñoz[4], Victor M.Castaño Meneses[5].
[1]Centre of Applied Physics and Advanced Technology Universidad Nacional Autónoma de México , Campus, Juriquilla, Querétaro 76230, QRO, México., Queretaro, Mexico, [2]Biomedicine Department, Universidad Autónoma de Querétaro. Qro-México., Queretaro, Mexico, [3]High Specialty Regional Hospital of the Bajio. León Guanajuato, México, Leon, Guanajuato, Mexico, [4]Department of Molecular and Celular Neurobiology, UNAM, Campus, Juriquilla, Querétaro 76230, QRO, México., Queretaro, Mexico, [5]Centre of Applied Physics and Advanced Technology) Universidad Nacional Autónoma de México, Campus, Juriquilla, Querétaro 76230, QRO, México., Queretaro, Mexico.

Objective: To apply confocal microscopy and non-conventional holographic techniques, for the three-dimensional reconstruction of cancer cell endomembranes.

Both confocal microscopy (CM) and holography (H) allow the capture of high quality images for their 3D reconstruction, while each technique varies in the way light is captured and processed. Combining both techniques with electron microscope grids of different sizes will hence allow a 3D reconstruction of higher quality and fidelity.

We hypothesize that, by placing grids of differently sized holes in our cell preparations, they will acts as multiple pinholes, increasing image resolution for its 3D construction as a digital hologram. The hologram produced would have higher spatial precision, due to wave optics phenomena.

Preliminary results of images captured with grids of differently sized holes (100, 50, 40 & 30μm) have shown a differential pattern in the fluorescence intensity. Additionally, image resolution distributes itself as a Gaussian. This may be due to the bar thickness of the grid interfering with the capturing of light. So far, these results show two important aspects: 1) The fluorescence intensity obtained is not proportional to the mesh size and 2) Image resolution behaves in a normally distributed way against the grid hole size.

Our prospects are therefore to use grids with specific characteristics (hole size and bar thickness) to create higher quality images and so more precise 3D reconstructions.

3873-Pos

Imaging Contrast and Biomechanics using Optical Coherence Tomography to Sense Superparamagnetic Iron Oxide Labeled Platelets

Amy L. Oldenburg, Thomas H. Fischer, Caterina M. Gallippi.
University of North Carolina at Chapel Hill, Chapel Hill, NC, USA.

Optical coherence tomography (OCT) provides 3D tissue imaging by contrasting light backscattering. OCT also senses nanoscale motions from optical phase shifts. We employ temporally modulated magnetic field gradients to mechanically displace superparamagnetic iron oxide nanoparticles (SPIOs). By locking in to the modulation frequency, SPIOs are contrasted in OCT, dubbed magnetomotive OCT (MMOCT).