Nanotechnology for Life Science

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JPK reports on the use of STM to study surface plasmons in the Molecular Science Group of ISMO – Institut des Sciences Moléculaires d'Orsay.

Berlin, February 7h, 2017: JPK Instruments, a world-leading manufacturer of nanoanalytic instrumentation for research in life sciences and soft matter, reports on how STM is being used to study surface plasmons in the Molecular Nanoscience Group of ISMO – Institut des Sciences Moléculaires d'Orsay – CNRS and the Université Paris-Sud.

One of the research goals of the Molecular Nanoscience Group of ISMO is to develop the idea of making circuits and devices in which *surface plasmons* (not electrons or photons) are used to transfer and manipulate information. However, why develop plasmonics when there are already solutions using electronics and photonics? Electronics have delivered miniaturization, such as computers which fit in the palm of the hand. However, electronics are fundamentally limited in speed by the generation of heat. Using photonics have successfully enabled fast data downloads from the Internet because optical fiber connections offer a high bandwidth. These are also limited, with the diffraction limit of light limiting the wavelength of light. The goal of the research group is to apply *plasmonics* to combine the advantages of electronics and photonics to produce miniaturized high bandwidth circuits and devices which use surface plasmons. To bring this to commercial reality, a local, low energy electrical source of surface plasmon polaritons is required.

For this research program to develop, group leader, Dr Elizabeth Boer-Duchemin takes up the story. "We propose to use an electrically biased tunnel junction as this local electrical plasmon source, and as a prototype, we consider the tunnel junction formed between the tip of a scanning tunneling microscope and a metallic sample. We chose to work with JPK for a number of reasons. First and foremost, the fact that the JPK STM is easily mounted on an inverted optical microscope (for surface plasmon detection) is essential for us. The design of the tip-assisted-optics (TAO) stage makes it easy to move both tip and sample independently. In our experiments, we use the STM to excite surface plasmons. These then radiate as photons which is the emitted light that we finally detect. I would also like to thank the engineering team at JPK who were extremely helpful in the project. This is a very unusual application and they played a vital part in the writing of specialised scripts to enable the work."

The Group has been very active in publishing papers on this work. In 2016, these included publications such as *Nanotechnology*[1] and *Optics Express*[2].

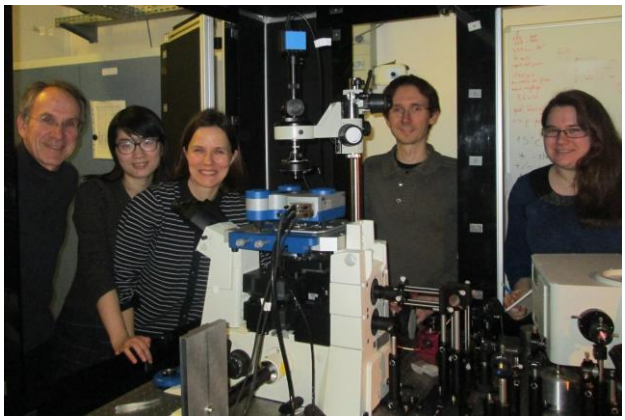
For more details about JPK's STM and AFM systems and their applications for the materials & nano sciences, please contact JPK on +49 30726243 500. Alternatively, please visit the web site: www.jpk.com or see more on Facebook: www.jpk.com/facebook and on You Tube: http://www.youtube.com/jpkinstruments.

References

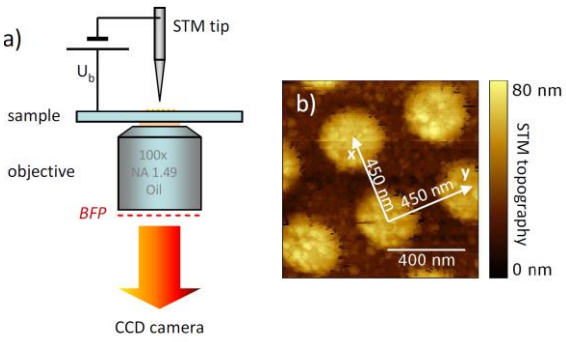
1 "The mechanism of light emission from a scanning tunnelling microscope operating in air", B. Rogez, S. Cao, G. Dujardin, G. Comtet, E. Le Moal, A. Mayne and E. Boer-Duchemin, *Nanotechnology*, **27**, 465201 (2016).

2 "Surface plasmon polariton beams from an electrically excited plasmonic crystal", D Canneson, E Le Moal, S Cao, X Quelin, H Dallaporta, G Dujardin & Elizabeth Boer-Duchemin, *OptExpress, **4**, 26186 (2016)*

Attachments



The Molecular NanoScience Group at ISMO, users of the JPK NanoWizard®: Gérald Dujardin (emeritus researcher); Shuiyan Cao (Ph.D. student); Elizabeth Boer-Duchemin (Associate professor); Eric Le Moal (CNRS researcher); Delphine Pommier (Masters student)



*STM plasmonic crystal: Schematic of the experiment and STM image of sample – a gold nanoparticle array (article OptExpress, **4**, 26186 (2016))*

For high resolution copies of the images, either right click to download or contact Jezz Leckenby at Talking Science.

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About JPK Instruments

JPK Instruments AG is a world-leading manufacturer of nanoanalytic instruments - particularly atomic force microscope (AFM) systems and optical tweezers - for a broad range of applications reaching from soft matter physics to nano-optics, from surface chemistry to cell and molecular biology. From its earliest days applying atomic force microscope (AFM) technology, JPK has recognized the opportunities provided by nanotechnology for transforming life sciences and soft matter research. This focus has driven JPK's success in uniting the worlds of nanotechnology tools and life science applications by offering cutting-edge technology and unique applications expertise. Headquartered in Berlin and with direct operations in Dresden, Cambridge (UK), Singapore, Tokyo, Shanghai (China), Paris (France) and Carpinteria (USA), JPK maintains a global network of distributors and support centers and provides on the spot applications and service support to an ever-growing community of researchers.

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