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Smart gold/polymeric-nanoparticles for theranostic and sensing applications in biomedical and environmental domains

Nripen Chanda[1], Moumita Ghosh[1], Dhananjay Suresh[2], Peuli Nath[1], Ravi K Arun[1], Ajit Zambre[2], Raghuraman Kannan[2] and Anandhi Upendran[2]
[1]CSIR-Central Mechanical Engineering Research Institute (CMERI), India
[2]University of Missouri, USA

Modern progress in nanotechnology has introduced a group of opto-electronically active metal or polymeric nanoparticles with attractive molecular and photo-physical properties suitable for various applications such as clinical diagnostics and environmental analysis. The present research trends have centered on exploring the fundamental optical, electrical and mechanical properties of new materials to efficiently enhance the performance of micro/nano-systems. In this presentation, we will showcase a novel synergism between the synthesis of Gold/Polymeric nanomaterials and their unique optoelectronic properties for two specific applications: (1) detection and treatment of deadly disease such as cancers and (2) fast, low-cost and in-field detection of environmental/biological toxins. The first part of the presentation involves the synthesis of size and shape dependent new gold nanoconstructs appropriate for theranostic applications in cancer management. The study will illustrate how cancer specific gold nanoparticles can be fabricated to target biomarkers present on cancer cells and used as image-contrast agents for the early detection and treatment of cancer. The second part includes the development of new micro/nanodevices as sensors for the rapid, low-cost and in-field detection of toxic heavy metal ions which are responsible for environmental pollution. The details of functionalized nanoparticles to produce significantly amplified optical signals through a small device having manifold receptors for analyte recognition will be explained. The significant outcome of this study is expected to develop a new technology that would enable the efficient detection of tracer level metal components in environmental and biological samples that are sometimes difficult to detect through traditional techniques.

Biography

Nripen Chanda is currently serving as Senior Scientist in the Department of Micro-System Technology, CMERI, Durgapur, India. He did Ph.D. from IIT Bombay, India and worked last seven years as a Postdoctoral Associate at University of Missouri-Colombia, USA. His research interests span over the areas of organometallic chemistry, catalysis and in the field of nanotechnology. He has published over 35 research papers in reputed journals. His current research activities include the design and development of micro/nano scale devices such as sensors, actuators, drug delivery systems and processes that opens up new opportunities for interdisciplinary research in the field of biomedical technology.

n_chanda@cmeri.res.in

Quantum mechanical spin effect in single-molecule electronics

O. G. Khvostenko
Ufa Research Center of Russian Academy of Sciences (IMCP URC RAS), Russia

Electron transport in the single-molecule electronic devices often shows the complex voltage-current curve that is indicative of the system switching between different conducting states. But until now this phenomenon is under discussion. Clarification can be given by another science branch devoted to the gas phase negative molecular ions (NMIs) investigations carried out with the spectroscopy of the resonance electron capture by molecules. The gas phase data can be really used herein because the molecule in the device takes the transited electron too, thus forming NMI which is precisely the same as the gas phase one, only subjected to the surfaces and the voltage influence. Among many gas phase NMI features, there is one which can be related to the device property to be switched into the blocking state. It is the ability of some gas phase NMIs that delay on themselves the additional electron for the anomalously long period of time (microseconds instead of femto-nano seconds). This is caused by formation via the intersystem crossing the NMIs of the quartet multiplicity, where the electron autodetachment is hindered by the spin prohibition. The same NMIs-quartets are believed to be formed in the device, where such ion is stabilized by the surfaces image potentials and by the parent ion shifting towards the positive charged electrode due to the voltage action. Then, the transited electron is delayed on the molecule like the gas phase phenomenon providing thereby the blocking state of the device.

Biography

O. G. Khvostenko has graduated from Odessa State University (Ukraine) in 1971, has got her Ph.D. in 1993 at Moscow Institute of Energy Problems of Chemical Physics of RAS, and Doctorate in 2005 at IMCP URC RAS. She has got the position of the leading scientist at IMCP URC RAS now, and she has published 37 papers in reputed journals.

khv@mail.ru