Abstract for an Invited Paper
for the MAR08 Meeting of
The American Physical Society

Integrated Functionality: Nanosensors

JOZEF T. DEVREESE, Theoretical Physics of the Solid State (TFVS), Universiteit Antwerpen, Belgium

Integrated nanosensors are nanostructured systems in which several sensors of different types have been integrated on a single platform including those sensitive to optical, magnetic, chemical, or biological stimuli [1,2]. Nanoparticle-based detector systems rely on the development of nanoparticles as sensing species. I discuss state-of-the-art nanosensors which are based on various advanced materials: nanoshells and nanorice, gold nanoparticles with attached fluorescent dyes, nanopores, carbon nanotubes, neuroelectronic hybrid systems, semiconductor nanocrystals and quantum-dot quantum wells (QDQW's). Phonon-assisted optical processes in semiconductor nanocrystals and QDQW's are highly sensitive to their shape and geometry i. a. due to the non-adiabaticity of the exciton-phonon systems. This sensitivity opens new perspectives for applications of quantum dots in optical sensing. For example, the simultaneous consideration of the tetrahedral shape of a CdS/HgS/CdS QDQW, interface optical phonons, and non-adiabatic phonon-assisted transitions allows for control of the photoluminescence of a QDQW [3]. Quantum-dot-based systems are also considered as examples of communication with nanodevices, which is a prerequisite of their integration. Nanosensors allow for building a new class of integrated devices, which provide the elemental base for "intelligent sensors" capable of data processing, storage and analysis. The development of integrated nanosensors could have many applications in several fields such as process monitoring, robotics, environmental, medical, consumer, homeland security... [1] I. K. Schuller, http://nanosensors.ucsd.edu/Introduction.htm. [2] J. T. Devreese and Y. Bruynseraede, Integrated Nanosensors. *McGraw-Hill 2008 Yearbook of Science & Technology,* McGraw-Hill, 2008. [3] V. A. Fonoberov, E. P. Pokatilov, V. M. Fomin, and J. T. Devreese, *Phys. Rev. Lett.* **92**, 127402 (2004).