Veneto Nanotech, the Italian Cluster for Nanotechnology: presentation, mission and research activity

Focus on luminescent silica nanoparticles for biological applications

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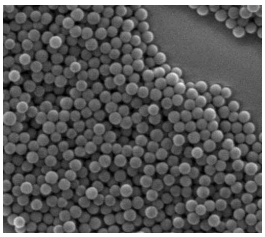
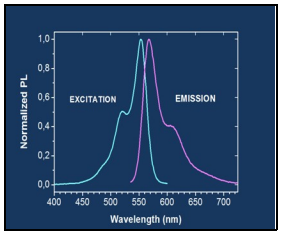
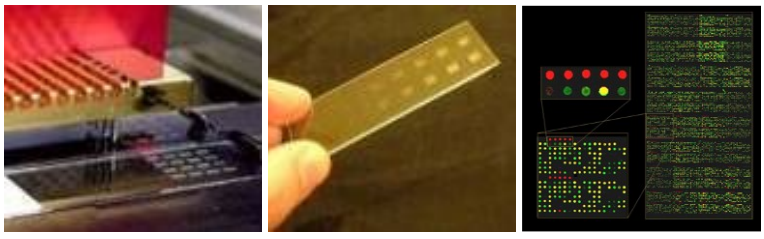
Veneto Nanotech is the **Italian Cluster for Nanotechnologies**. Located in the Veneto Region (north-east of Italy) it is the first Italian laboratory fully dedicated to the transfer of nanotechnologies to industrial production and one of the most advanced platforms for developing research activities in the field of nanotechnologies.
Veneto Nanotech has three advanced laboratories with different specific missions: NANOFAB (focused on the development of new materials), LANN (dedicated to nanofabrication of devices) and ECSIN (the European Center for the Sustainable Impact of Nanotechnologies). These laboratories act in strong cooperation with Universities and Industrial partners.
After a **general overview** on the role, mission and research activities of the Cluster I will focus on the specific theme of luminescent nanostructured materials and in particular in the use of **luminescent silica nanospheres**



for biological applications. In the biological context a variety of nanomaterials promise to offer sensitive, rapid and cost-effective solutions for modern **clinical laboratory**. In particular, dye-doped silica nanoparticles (NPs) have been demonstrated to be sensitive labeling markers for biosensing and bioimaging. Their flexible conjugation, excellent photostability, and ultrasensitivity make them a powerful tool in bioanalysis. Indeed luminescent dye-doped nanoparticles are excellent candidates for biological applications because (1) they can be analyzed with the standard existing tools (**microarray scanners, optical fluorescence microscopes**), which are fitted for fluorophore excitation and emission curves, (2) a large number of dye molecules can be incorporated in a single particle, increasing the optical signal and (3) the silica matrix provides a protective barrier minimizing photobleaching and photodegradation.



The optimization of the synthesis process to obtain **higly luminescent particles** with controlled morphological properties is presented. Moreover, application of these luminescent silica nanoparticles to DNA microarray technology is also reported. **DNA microarray** is a powerful tool for the parallel, high-throughput detection and quantification of many nucleic acids and other biologically significant molecules. Application on the detection of carcinogenic risky Human Papilloma Virus using DNA microarray technology is shown, comparing our system to conventional dye labelling or commercial quantum dots, demonstrating a significant increase in optical signal, and a related decrease of the limit of detection, thus giving a **remarkable improvement** in this technique towards early **diagnosis of diseases** and trace level detection of dangerous biological contaminants.



Dye doped silica nanoparticles used to enhance the optical signal of a DNA microarray diagnostic tool

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