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Optical Si-based biosensors: First results

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Optical biosensors based on the use of fluorescent dyes are commonly employed in biomedical applications (e.g. DNA microarray). The optical signal is the transduction mechanism used to recognize DNA hybridization between probes anchored on a surface and the labelled DNA target. Labelling is performed conjugating optical fluorophores to the target DNA molecule and the detection system is based on optical scanners or CCD cameras. Finally, optical images are elaborated in a post-acquisition analysis through complex softwares. Aim of our work was the fabrication and characterization of optical biosensors using traditional and novel fluorescent dyes and a novel sensor. The fluorophores used are the traditional CY5 and a newer organic molecule, the Ru(bpy)₃²⁺, while the photodetectors are a pixel array of solid state photon-detectors (Silicon Photomultipliers, SiPM), produced by ST Microelectronics in Catania. These devices have been also employed to study the dyes emission features (lifetimes and emission spectra). Finally, SiPM were used as photon counters to detect the fluorophore signal of dyes coupled to single-strand (ss) or double-strand (ds) DNA. Pulsed measurements performed on Cy5 emission allowed us to conclude that SiPM can be used as photon counter also for biosensing applications. The use of Ru(bpy)₃²⁺, exhibiting a large difference between the excitation and the emission wavelengths, could allow to implement new detection systems, also enabling different detection parameters, such as the fluorophore lifetime.

Biography

S Libertino got her PhD (1998) at the University of Catania. From 1997 she works at the Microelectronic and Microsystems institute (IMM) of the Italian National Council of Research (CNR), since 2007 with the role of Senior Researcher. Her research interests are oriented to the design and fabrication of Si-based microelectronic and optoelectronic devices and to biological molecules integration in these devices for sensor applications. She has co-authored 3 chapters of books and more than 100 papers published in international journals. She holds 3 European patents, all extended to USA.

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