Photonics based on carbon nanotubes

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The bit rate request for optical telecommunications networks is continuously growing, in order to provide high speed internet all over the world. However, in long-haul optical fibers the quality of information transmission requires all-optical regeneration of the telecom signal, as it is damaged through its propagation. Our work focuses on designing efficient all-optical devices based on ultrafast dynamics and nonlinear optical properties of nanomaterials. We have highlighted nonlinear optical properties of carbon nanotubes (CNT), in direct comparison with quantum wells (QW) [1,2,3]: CNT present ultrafast absorption dynamics and large 1D-excitonic nonlinearities. We aim at demonstrating the huge potential of CNT-based optical devices for high-bit-rate telecom applications, as simple-process and low-cost solution in comparison with QW-based devices [4]. Furthermore, we have reported a special behavior of CNT light emission with temperature: from 77K to room temperature, no shift of emission wavelength is observed [2], in contradiction with well-known Varshni's law for semiconductor materials [5]. This behavior confers great interest to CNT for new photonics sources with higher performances. Thus, we will present our research studies on passive as well as active photonics devices based on CNT for telecom applications.

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