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## Structural and magnetic properties of nickel-cobalt nanomaterials synthesized by citrate-gel auto combustion method

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Nano-ferrites of the composition  $Ni_{1-x}Co_xFe_2O_4$  (where  $x=0.0, 0.2, 0.4, 0.6, 0.8$  and  $1.0$ ) were synthesized at a very low temperature ( $180^\circ C$ ) by citrate-gel auto combustion method. The synthesized powders were sintered at  $500^\circ C$  for four hours in an air and were characterized by X-ray diffraction (XRD) which confirmed the formation of cubic spinel structure of ferrites. The crystallite size was in the range of 20 nm to 31 nm. Nanosized ferrites with uniform particle size and narrow size distribution are desirable for a variety of applications like targeted drug delivery, medical imaging magnetic data storage, and other biomedical applications, magnetic data storage, etc. Morphological studies by Transmission electron Microscopy (TEM), Scanning Electron Microscopy (SEM) revealed formation of largely agglomerated, well defined nano particles of the sample. Elemental composition characterizations of the prepared samples were performed by Energy Dispersive Spectroscopy (EDS) which shows the presence of Ni, CO, Fe and O without precipitating cations. Magnetic properties of Ni-Co nanoferrites were measured using a vibrating sample magnetometer at roomtemperature in the applied field of 15 kOe. The specific saturation magnetization ( $M_s$ ), remanent magnetization ( $M_r$ ) and the coercivity ( $H_c$ ) of the spinel ferrites are further improved by the substitutions of  $Co^{+2}$  ions.

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## Tuning the optical properties of quantum dots in high-efficiency excitonic solar cells

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Due to their unique optical features, semiconductor quantum dots (QDs) are often presented as the ultimate frontier as sensitizers for photoelectrochemical solar cells and LEDs. In excitonic solar cells, the QD absorbs the incident radiation, an exciton is created, and charge separation occurs at the interface between the QD and the electron transporter (typically a wide bandgap semiconductor). The control and proper modulation of exciton dynamics is critical in determining the performance of the device by regulating charge generation, separation and collection, and intense research is developed to optimize the matching between QDs and wide bandgap semiconductors ( $TiO_2$ ,  $ZnO$ ,  $SnO_2$  among the most applied). Up to now, the most interesting results in terms of device performances have been obtained by using poly-dispersed, *in situ* generated QDs by means of successive ionic layer absorption and reaction (SILAR) technique. This approach allows obtaining naked QDs directly grown on the porous structure of the metal oxide photoanodes, thus guaranteeing an intimate contact between the two interfaces. Moreover, the deposition of networks of QDs presenting absorption features able to collect a wider region of the solar spectrum is possible by tuning the composition of QDs using mixed systems (like, for instance, CdS and PbS QDs). We will present an overview of photoelectrochemical systems composed of metal oxide semiconducting photoanodes sensitized with semiconducting QDs and we will discuss possible strategies to tailor the optical properties of the system to maximize its photoconversion efficiency.

### Biography

Alberto Vomiero is researcher at the SENSOR Lab of the National Research Council (Italy). He was awarded his PhD in Electronic Engineering from the University of Trento in 2003 and his Degree in Physics from the University of Padova in 1999 with full marks. His main research interests involve the investigation of composite nanomaterials for chemoresistive and optical gas sensors, and high efficiency dye- and quantum dot-sensitized solar cells. He is Marie Curie International Outgoing Fellow of the European Commission, Fellow of the Institute of Physics and of the Institute of Nanotechnology, Chair of the Italian section of the American Nano Society, Member of the Global Young Academy and visiting scientist at the Universidad de La Habana, Cuba.

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