

# 3<sup>rd</sup> International Conference and Exhibition on Materials Science & Engineering

October 06-08, 2014 Hilton San Antonio Airport, USA

## Colloidal semiconductor-plasmonic copper sulfide nanocrystals

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Colloidal nanocrystals with heavily doped structure represent an interesting class of dual-functional nanomaterials, in which the distinctive optoelectronic properties of low-dimensional semiconductors and localized surface plasmon resonance (LSPR) response, typical of noble metals, are combined. The plasmonic behavior originates from excess free carriers associated with cation/anion vacancies or ionized dopant atoms in the lattice, leading to intense extinction bands at near-infrared (NIR) wavelengths. In this talk, the author will discuss a surfactant-assisted nonaqueous synthesis of anisotropic-shaped copper sulfide ( $\text{Cu}_{2-x}\text{S}$ ) nanocrystals, trapped in selected crystal structures, which exhibit intense, size-tunable LSPR at NIR frequencies. The composition and geometry dependence of LSPR features are interpreted on the basis of theoretical calculations performed by the Discrete Dipole Approximation (DDA) method. Particular emphasis is put on the assessment and interpretation of optical properties of nanocrystals in the metallic-like covellite structure (CuS), which can support LSPR response due to a significant density of lattice-constitutional valence-band free holes in their stoichiometric (undoped) lattice. As a consequence of the unique electronic properties of the CuS nanocrystals and of their monodispersity, coherent excitation of symmetric radial breathing modes has been detected for the first time in transient absorption experiments at LSPR wavelengths.

### Biography

P Davide Cozzoli received his PhD Award in Chemical Sciences in 2004 from the University of Bari, Italy. Since 2007, he is Senior Staff Researcher at the University of Salento, Lecce, Italy. Currently, he leads the Nanochemistry Division of the National Nanotechnology laboratory of CNR Nanoscience Institute, Lecce, Italy, and serves as Associate Editor of Science of Advanced Materials, Journal of Nanoengineering and Nanomanufacturing, Materials Focus, and Journal of Crystallography. His research interests involve development of advanced inorganic nanoparticles for applications in catalysis, photovoltaics, energy storage, and biomedicine. So far, he has published about 105 papers (H-index=31).

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## Nanoenhanced and oriented poly (ε-caprolactone) scaffolds promote fibrocartilage formation

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Previous studies from this lab have established that the TMJ discs' ability to absorb and dissipate compressional, shear and tensional forces can be attributed to its microheterogeneous extracellular matrix. The TMJ disc exhibits a complex collagenous fiber organization. In the intermediate zone, the orientation of collagenous fibers is in a predominantly anteroposterior fashion that splays out, in both a mediolateral and craniocaudal direction, to interlace with circumferentially collagenous fibers in the band regions. Focal deposits of interstitial hyaline cartilage-like matrix are present in both the anterior and posterior bands. We reproduced the major architectural system (collagen fiber orientation) through the use of growth factor doped halloysite nanotubes spun within an aligned PCL scaffold. Results showed that seeded TMJ fibrochondrocytes and osteoblasts thrived within the scaffold, aligned along the oriented fibers, and produced a fibrocartilagenous matrix. The results support the potential use of clay nanoenhanced PCL scaffolds as a viable scaffold for repairing or regenerating damaged or diseased TMJ tissues.

### Biography

David K Mills received his PhD in 1990 from the University of Illinois and joined the faculty at Louisiana Tech University in 1994. He holds a joint faculty appointment in the Center for Biomedical Engineering and Rehabilitation Science and the School of Biological Sciences. He has over 50 papers published in national and international and has directed over 80 MS and PhD students in the fields of Biology, Biomedical Engineering, Chemical Engineering and Molecular Science and Nanotechnology. He is the President of OrganicNano, a Louisiana based company focused on the development and commercializing halloysite nanotube technology and bioactive polyelectrolyte multi-composite nanocoatings.

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