Hydrophobic gold nanoparticles coupled with fluorescent dyes: a smart tool for optoelectronic applications

Sara CERRA – *Sapienza University of Rome*

Gold nanoparticles (AuNPs) represent fascinating nanomaterials showing unique chemical, electrical, and physical properties due to quantum effects. Key properties of nanoparticles can be tailored by altering their physical geometries or modulating the surface stabilizing agent. Spherical AuNPs offer resonance wavelengths in the visible region (known as the Localized Surface Plasmon Resonance phenomenon, LSPR) that strongly depend on the size, shape, surface functionality, and agglomeration state. The LSPR phenomenon coupled with advances in nanomaterial syntheses, surface stabilization, and self-assembly has improved the use of gold nanostructures for optical, electrical, and optoelectronics applications. Recently, we explored the functionalization of AuNPs with different surface ligands: (i) mono- and bifunctional synthetic 9,9-didodecyl-2,7-bis(acetylthio)fluorene (FL) derivatives bearing a conjugated, rigid, organic moiety, and (ii) synthetic organic fluorescent dye (2AET). AuNPs growth was obtained by a two-phase wet chemical reduction method starting from gold(III) containing precursor under inert conditions at room temperature, using $NaBH_4$ as the reducing agent. During synthesis procedure, ligands were used in mixture (FL/2AET) exploring different molar ratios to obtain both single and interconnected AuNPs networks stable in organic media. Extensive surface characterization was carried out by spectroscopic techniques (UV-Vis, FTIR), nuclear magnetic resonance (NMR). In colloidal suspension, the hydrodynamic diameter value was evaluated by dynamic light scattering (DLS). Morphological studies were done at solid-state via microscopy techniques. To extend the versatility of these systems, blends of AuNPs with poly(phenylacetylene) (PPA), were prepared. Electric response of pristine functionalized AuNPs and nanocomposite systems were assessed via I/V measurements onto spin coated electrodes to investigate their potential applications in various optoelectronic fields.