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Ionic liquids: Synthesis optimization and biosensor properties evaluation

Gerardo González-Aguilar
INESC TEC, Portugal

Ionic liquids (IL) have been receiving in the last decades, and even more recently, an enormous amount of interest as they have shown very interesting physicochemical properties. Usually characterized by high thermal stability, interesting electrochemical properties, negligible vapor pressure and limited solubility in various solvents. These features have prompted their usage in several organic synthesis, capacitors , solar and fuel cells, among several other applications. However, one of its drawbacks is the cost of production, therefore our group is interested in developing novel cheap ionic liquids. Several ILs have been synthesized and their chemical/electrochemical characterization is underway. Simultaneously, computational calculations for the assessment of their optical properties were carried and the possibility of obtaining new derivatizations with added value are being evaluated. Finally, its use in bacterial recognition and quantification is being studied.

gaguilar@fc.up.pt

Synthesis and applications of metal organic framework nanopillars

Hai-Feng Ji
Drexel University, USA

Metal-organic frameworks (MOFs) are coordination network materials that are composed of metal ions and organic molecules. MOFs have exceptionally high specific surface areas and chemically tunable structures. Due to their unique inorganic–organic hybrid nature and porous structures at the nanometer scale, it is expected that MOFs are rich in fundamental properties that promise revolutionary new device concepts. Research in the fields of MOFs is rapidly expanding into broader applications of 1D micro/nanostructures and 2D coatings into MOF-based devices. Recently, we developed the first example of a novel and unique MOF-based 1D vertical micro/nanopillar on gold surface by using a facile surface-assisted method. One end of each micro/nanopillar is mechanically connected to the surface when the micro/nanopillars are fabricated. The uniqueness and advantage of the micro/ nanopillar technique is that the structures are directly connected to the surface by being grown in place. Being porous, the MOF micro/nanopillars may have applications for unique photonics, surface catalysis, surface gas adsorption, purification, sensing devices etc.

hj56@drexel.edu