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Design of optical and electrochemical sensors based on porphyrin nanoparticulated systems

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Four different nanocomposites were prepared by combining Fe (III) and Cu (II) porphyrins. The nanostructured surfaces were obtained by sequential electrochemical deposition of the porphyrins (poly FeCuPP) onto immobilized gold nanoparticles or doped with multiple walled carbon nanotubes (MWCN) during deposition. These devices show great stability and interesting electrochemical properties that were thoroughly studied. The charge transfer properties of the nanostructured electrodes were evaluated by Electronic Impedance Spectroscopy (EIS). The electrocatalytic response to hydrogen peroxide was measured by cyclic voltammetry and amperometry. These techniques were used to evaluate the response to a variety of competitive and non competitive ligands, explaining their behavior in terms of the molecular interaction with the nanostructures. The morphology of the nanostructured electrodes was analyzed by SEM. On the other hand, tetra pyridil metalloporphyrins were deposited onto modified glass surfaces with gold nanoparticles and characterized by UV-visible, FTIR, Raman and SEM. This organization was utilized to evaluate the optical response of the chomophore to different ligands with the idea of develop high sensitivity optical sensors. Finally, nanorods of Fe (III) and Cu (II) porphyrins were prepared and characterized by UV-visible, FTIR, Raman and TEM. In this case, circular dichroism resulting very interesting since it allowed detecting asymmetric ligands included in the nanostructures.

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Nanocatalysis in carbon-carbon and carbon-heteroatom bond formation

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Palladium catalysis had an enormous impact on the development of organic synthesis in the 20th century (Nobel prizes in 2001, 2005 and 2009). Such reactions as Suzuki and Heck made the building of new C-C bonds a routine procedure. However, this catalysis required the use of expensive and often toxic ligands, especially phosphines. The use of colloidal palladium could not satisfy the demands of industry and did not allow for the recycling of the catalyst. Nanocatalysis is becoming increasingly popular in the 21st century, including the catalysis by PdNPs. The stabilization of PdNPs required the use of solid and soft supports, which also provided a means of easy separation of the catalyst and its recyclization. Yet, the mechanism of these reactions is still the subject of intense debate. In the present report we will try to highlight this problem by the examples from various C-C bond forming reactions (Suzuki, Heck, cyanation, carbonylation) and will offer our solution to the problem. Besides some AuNPs catalyzed reactions and the influence of the support on the reaction results will be considered.

Biography

Irina P Beletskaya received her Diploma in 1955, her PhD degree in 1958, and her Doctor of Chemistry degree in 1963 from Moscow State University. She became a Full Professor at Moscow State University in 1970, a corresponding member of the Academy of Sciences (USSR) in 1974, and a full member (Academician) in 1992. She is currently Head of the Laboratory of Organoelement Compounds, Department of Chemistry, Moscow State University. She is Chief Editor of the Russian Journal of Organic Chemistry. She was President of the Organic Chemistry Division of IUPAC from 1989 to 1991. She was a recipient of the Lomonosov Prize (1979), the Mendeleev Prize (1982), The Nesmeyanov Prize (1991), the Demidov Prize (2003), the State Prize (2004) and the Arbusov Prize (2007). She is the author of more 1000 articles and a number of monographs. Her current scientific interests are focused on organoelement compounds, transition metal catalysis in organic synthesis and organocatalysis.

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