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Conjugated-carbon nano-structures: Benzenoids, fullerenes, polymers, nano-tubes, graphene, etc

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Conjugated carbon structures have long been known, including benzenoid molecules, graphite, charcoal, & coal, many of industrial importance: as solvents, as dyes, as drugs, as feedstock for plastics, as an energy source (like coal), & more. Such species are central in photosynthesis, respiration, & vision–and some other bioactivities. But in the last ~3 decades there have been revelatory developments for novel new conjugated-carbon nano-structures: polyacetylene, buckminsterfullerene, carbon nano-tubes, & single-layer graphene, etc – resulting in 3 Nobel prizes. For these new conjugated-carbon species, there are multifarious speculations as to nano-scale uses: for conjugated-carbon polymers as flexible organic metals; for fullerenes as nano-capsules; for carbon nano-tubes in electronic nano-circuits, in nano-elevators to space, & in chemical nano-sensors; for graphene sheets in electronic or "spintronic" nano-devices, or perhaps in a radical "quantum computer". Finally there are societal problems with conjugated carbons: several being carcinogenic, some being a major contributor to soot, and coal burning being one of the dirtier forms of energy production, delivering an especially high dose of the greenhouse gas CO_2 per unit of energy generated. All this invites associated theoretical development for these novel species. Here we address some general ideas: as to fullerene stability, nano-tube conductivities, and properties of decorated graphene species.

Biography

Douglas J Klein obtained Master's & Doctoral degrees at University of Texas (at Austin) in Physical Chemistry in 1967 & Chemical Physics in 1969. He was Asst. Prof. of physics at UT 1971-1977, and on the faculty since 1979 at Texas A&M University at Galveston, with visits (of 3 to 21 months) at Office of Naval Research and different Universities: Princeton, Köln, Rice, & Oxford. He has published over 300 research papers in chemistry, physics, & math (as well as two co-edited books). His work has been on: group-theory applications, semi-empiricism for donor-acceptor crystals, permutational isomerism, many-body theory, polymer statistics, resonating valence-bond theory, chemical graph theory, carborazenes, and especially general characterizations of conjugated-carbon nano-structures.

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Synthesis of a new ligand with highly extractability and selectivity for palladium and nano-palladium particles

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The increasing concern towards protection of the environment, energy saving and optimization of a wide range of industrial processes in both nuclear and non-nuclear fields imposes the need for development of advanced separation techniques in particular for liquid waste and effluents. The R&D effort on the partitioning is presently concentrated on development and improvement of innovative extractants as alternative technologies. However, employment of new reagents and development of new processes must be reconciled with 21st century expectations for environment protection. Solvent extraction is a hydrometallurgical technique for recovery of precious metals with simple process and good separation. Recently, the separation of precious metals has become very important due to rapidly growing demand of the metals in the field of electronic devices, autocatalysis, etc. Nowadays, various ligands have been developed for this purpose. However, these ligands suffer several limitations like slow kinetics of extraction, low solubility, poor decontamination factor, pH sensitivity and instability in acidic medium. We have recently design and development a new extractant (S) donor ligand namely thiodiglycolamides for precious metal separation. Selective separation of Pd(II) ions over some base metal ions was also investigated. The developed method was applied to spent auto catalyst for nano-palladium recovery.

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