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Third-generation solar cells based on copper quaternary compounds with the kesterite structure 99

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The current state of studies related to increasing the efficiency and reducing the cost of solar energy converters is analyzed. One way to solve this problem is to use absorbing layers made of a new, poorly studied class of semiconductor materials based on copper quaternary compounds $\text{Cu}_2\text{ZnSnX}_4$ ($\text{X} = \text{S}, \text{Se}$) with the kesterite structure. Methods of synthesis and chemical composition of such absorbing layers are discussed. Types and principles of functioning of thin-film solar cells and the key factors affecting the performance of these devices are considered.

Bibliography 173 references.

Inorganic nanoparticles as nucleic acid transporters into eukaryotic cells 113

R.N.Amirkhanov, V.F.Zarytova, M.A.Zenkova

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The review considers inorganic (titanium, silicon and iron oxides, calcium phosphate and gold) nanoparticles used as nucleic acid transporters into mammal cells. The methods of synthesis of nanoparticles and the ways of surface modification by covalent and non-covalent attachment of small molecules and polymers are presented. The data available from the literature on the biological action of nucleic acids delivered into the cells by nanoparticles and on the effect of nanoparticles and their conjugates and complexes on the cell survivability are summarized. The nanoparticle internalization pathways in the cells and the mechanism of their excretion as well as the ways of release of nucleic acids from their complexes with nanoparticles after getting into the cell are described.

Bibliography — 161 references.

R.I.Khusnutdinov, T.M.Oshnyakova, U.M.Dzhemilev

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The review presents the first analysis and systematic discussion of data published in the last 35–40 years on the use of molybdenum compounds and complexes in organic synthesis and catalysis of various ion coordination and radical reactions. Detailed account is given of the key trends in the use of molybdenum complexes as catalysts of reactions such as alkene epoxidation and oxyketonation, oxidation of sulfur-, nitrogen- and phosphorus compounds, hydroxylation of 1,3-dienes, ketones and aldehydes, hydrostannylation of acetylenes, and hydrogermylation of norbornadienes. Considerable attention is paid to the description of new reactions and *in situ* generation of highly reactive ROX and HOX hypohalites using molybdenum complexes and the use of these hypohalites in various oxidative transformations. Data on the application of molybdenum complexes in well-known reactions are discussed, including Kharasch and Pauson–Khand reactions, allylic alkylation of C-nucleophiles, aminocarbonylation of halo derivatives and oligomerization of cyclic dienes, trienes, alkynes and 1,3-dienes. The last Section of the review considers ‘unusual’ organic reactions involving molybdenum compounds and complexes.

Bibliography — 257 references.

Organic conductors and superconductors based on bis(ethylenedithio)tetrathiafulvalene radical cation salts with supramolecular tris(oxalato)metallate anions

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The results of studies of the families of conductors and superconductors based on bis(ethylenedithio)tetrathiafulvalene radical cation salts with paramagnetic and diamagnetic supramolecular tris(oxalato)metallate anions are collated and analyzed. Methods for the preparation of these salts and various types of packing of the conductive layers within the salt structure are considered. The transport properties of crystals of the salts of this family and the effect of guest solvent molecules on these properties are discussed. The contribution of scientists of the Institute of Problems of Chemical Physics to the research of organic conductors and superconductors is noted.

Bibliography — 70 references.