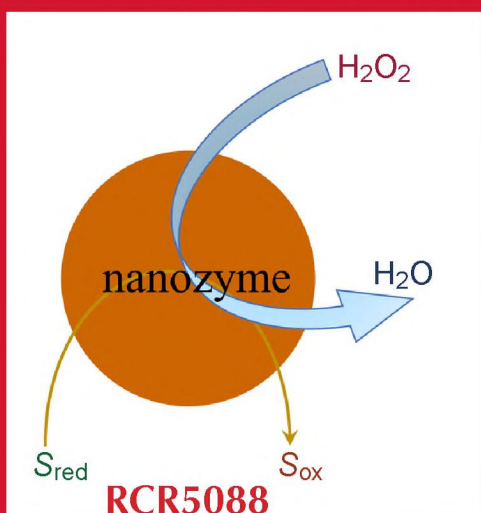
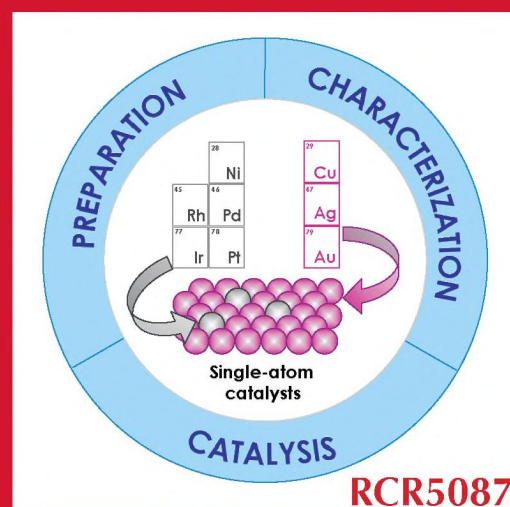




Успехи химии



Обзорный журнал по химии

Том 92 Номер 8 2023

ISSN 0042-1308

Успехи химии

Том 92
Номер 8
2023

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Recent advances in lignins: fundamentals and applications

RCR5082

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Lignin, one of the most abundant biopolymers on Earth, is a constant object of numerous fundamental and applied studies. Lignin processing is a challenging task of biorefining. Recent publications mainly concern various directions of valorization of technical lignins, as well as applications of lignin in medicine and pharmacology, 3D printing, synthesis of carbon fibres and biofuels. In the field of fundamental research, studies on lignin biosynthesis are of special attention. The review is devoted to the latest advances in the chemistry of lignin. The currently available data on the structure and biosynthesis of lignin are discussed. The trends in lignin valorization, such as pyrolysis and carbonation, production of composites, copolymers and nanoparticles, synthesis of practically valuable low-molecular-weight substances, production of hydro- and aerogels, *etc.*, are analyzed in detail. It is noted that at present, the practical application of lignin is developing in two directions: valorization of technical lignins *per se*, without prior depolymerization, and valorization *via* low-molecular-weight compounds, mainly monomers, formed through lignin degradation by various methods.

Bibliography — 130 references.

Progress in single-atom methodology in modern catalysis

RCR5087

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The review analyzes the development of the single-atom catalyst methodology from single-site to single-atom alloy systems. Here we considered in detail the issues of preparation and characterization of single-atom catalysts, as well as their use in a number of key catalytic reactions, including selective alkyne hydrogenation. The possibility of fine-tuning the surface structure of single-atom alloy catalytic systems using adsorbate-induced segregation is analyzed for the first time.

Bibliography — 312 references.

Catalytic properties of peroxidase mimicking nanozymes

RCR5088

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Herein is the first attempt to critically review the catalytic properties of peroxidase mimicking nanozymes. For this aim the main factors affecting nanoparticles activity are discussed, and the catalytic properties are normalized allowing true comparison of different nanomaterials. The highest catalytic activities in hydrogen peroxide (H₂O₂) reduction have been recorded for nitrogen-coordinated iron atoms (FeN₄, FeN₅). However, the main disadvantages of metal/metal oxide as well as ‘single atom’ nanozymes are their additional activities in oxygen reduction and H₂O₂ dismutation, impairing their application abilities. Nanoparticles catalytically synthesized from the most advantageous electrocatalyst (Prussian Blue) display enzymatic selectivity in addition to the highest catalytic activity. This may indicate simultaneous electron donation to H₂O₂ from different iron atoms. Accordingly, perspective synthesis of ‘single atom’ nanozymes can be carried out considering bi-metallic (Fe–Fe like) structures in addition to the presently synthesized ones.

Bibliography — 121 references.

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The experimental and theoretical chemistry of 1,2,3,4-tetrazines has been actively studied in the last 20 years. The increasing interest in this class of compounds is due to the fact that the 1,2,3,4-tetrazine ring is a promising building block for the development of energetic and physiologically active compounds. The review considers various types of 1,2,3,4-tetrazines including completely unsaturated non-annulated tetrazines and their N-oxides; nitrogen-substituted tetrazines; annulated tetrazines with a nitrogen atom common to two heterocycles; 1,2,3,4-tetrazine 1,3-dioxides fused to benzene, pyridine, 1,2,3-triazole and 1,2,5-oxadiazole rings; and also 1,2,3,4-tetrazine 1,3-dioxide fused to one more 1,2,3,4-tetrazine 1,3-dioxide ring. Methods of synthesis and reactivity of these compounds, their crystallographic features, spectral characteristics and thermal stability are described. The results of quantum chemical studies for 1,2,3,4-tetrazine derivatives are considered. The prospects of using 1,2,3,4-tetrazines as energetic compounds are discussed.

Bibliography — 189 references.