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### **Verdazyls: synthesis, properties and applications**

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G.N.Lipunova, T.G.Fedorchenko, O.N.Chupakhin

*I.Ya.Postovskii Institute of Organic Chemistry, Urals Branch of Russian Academy of Sciences*

Methods for the synthesis, structure, properties and reactivity of stable heterocyclic radicals, verdazyls, are considered. The attention is focused on the metal complexes of verdazyls. The information about the main applications of these radicals is given. Bibliography — 164 references.

### **Graphene-like transition metal nanocarbides and nanonitrides**

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A method for the synthesis of MXenes, a new family of graphene-like quasi-two-dimensional d-metal nanocarbides and nanonitrides with non-trivial properties and interesting prospects of technological applications, is considered. The experimental data on the properties and the results of theoretical modelling of the structure, conditions of stability, and electronic and magnetic characteristics of a broad range of MXenes, their oxidized, fluorinated and hydroxylated derivatives and nanoscrolls and nanotubes based on them are generalized. The key trends and prospects for the subsequent investigations of this unique family of 2D nanomaterials are noted. Bibliography — 67 references.

### **Direct nucleophilic functionalization of C(sp<sup>2</sup>)-H bonds in arenes and heteroarenes by electrochemical methods**

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A.V.Shchepochkin, O.N.Chupakhin, V.N.Charushin, V.A.Petrosyan

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*Ural Federal University named after First President of Russia B.N.Yeltsin*

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Published data on electrochemical methods and approaches used for direct functionalization of the C(sp<sup>2</sup>)-H bond through nucleophilic displacement of hydrogen (S<sub>N</sub><sup>H</sup> reactions) are surveyed and described systematically. The most important features of preparative electrochemical processes are considered. The attention is concentrated on the synthetic potential of the discussed transformations. Bibliography — 133 references.

### **Mixed-conducting ceramic membranes and their applications**

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V.L.Kozhevnikov, I.A.Leonidov, M.V.Patrakeev

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The works dealing with the design of catalytic reactors with ceramic membranes having mixed oxygen-ion and electronic conduction in which oxygen separation and oxidation processes can be integrated are analyzed and generalized. This approach is of interest for the development of energetically effective and environmentally safe processes for natural gas and other feedstock processing. The general problems related to implementation of the primary processing of light hydrocarbons in reactors with oxygen separation membranes are discussed and the key requirements imposed on the materials for these membranes are listed. Primary attention is devoted to oxidative conversion of methane to synthesis gas. Bibliography — 110 references.

### **Nano-sized melphalan and sarcolysine drug delivery systems: synthesis and prospects of application**

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V.P.Krasnov, M.A.Korolyova, E.L.Vodovozova

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*M.M.Shemyakin – Yu.A.Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences*

The results of experimental studies concerned with the development of nano-sized drug delivery systems for antitumour drugs sarcolysine and melphalan are generalized. The structures and biological activities of nanocarriers in comparison with unmodified drugs are discussed. Particular attention is given to the liposomes containing lipid derivatives of sarcolysine and melphalan in the lipid bilayer. Bibliography — 196 references.