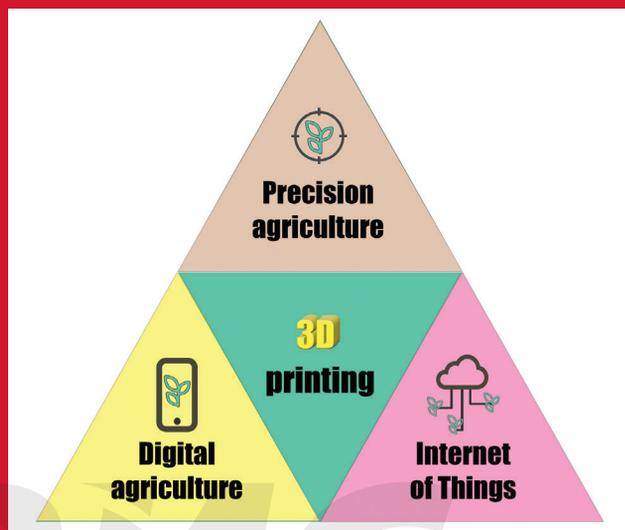
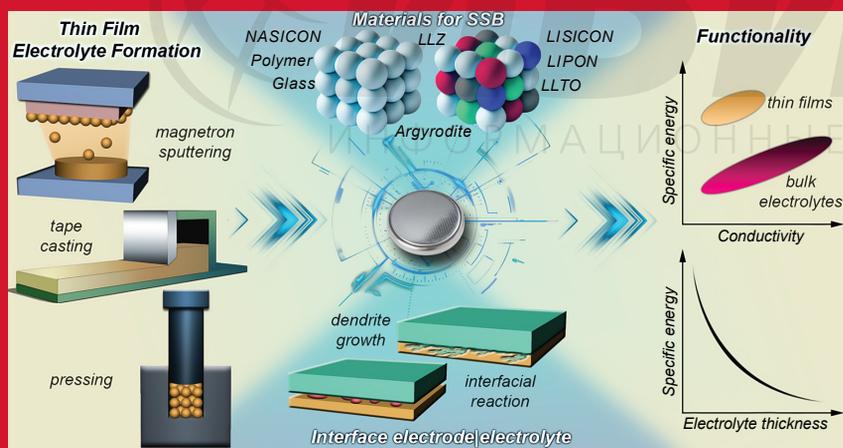


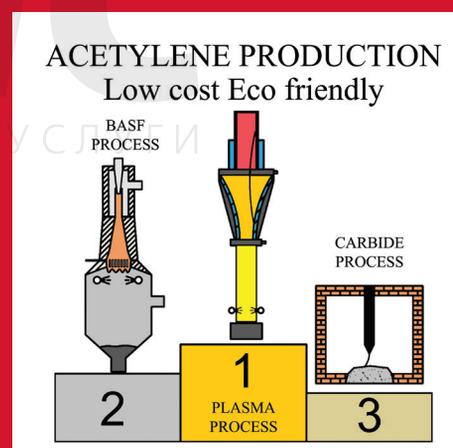
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# Russian Chemical Reviews

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### **From bulk to thin-film electrolytes in all-solid-state batteries: challenges and opportunities**

**RCR5171**

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Currently, transition to all-solid-state batteries from common lithium-ion batteries containing liquid electrolytes is relevant due to the risk of self-ignition and even explosion of the latter devices. Furthermore, for solid electrolytes, lithium metal, which has record high specific capacity compared to currently used carbon materials, can serve as the anode. This review analyzes for the first time the possibilities of transition to thin-film solid electrolytes in lithium power sources. The review addresses the set of problems related to material synthesis, technological principles of the formation of electrolyte samples of various thicknesses, and conductivity of electrolyte films that can be achieved. The set of data concerning the relationship between the electrolyte conductivity and film thickness is considered; the problem of specific conductivity decrease upon a decrease in the thickness of the electrolyte film is addressed. The implemented approaches to solving the problems of material degradation in the electrode–electrolyte interfacial region are systematized.

Bibliography — 282 references.

### **Additive manufacturing in agriculture**

**RCR5187**

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Agriculture, which is the foundation of human civilization, faces challenges that require innovative solutions to ensure sustainable and efficient production. This review examines the potential of additive technologies for modernizing the agro-industrial complex and, in particular, their role in the development of precision and digital agriculture. Particular attention is paid to the possibilities of 3D printing in digital design, fabrication of sensors and devices, and improving the environmental sustainability of agricultural systems. Additive technologies play a key role in the rapid prototyping of tools and equipment, enabling the rapid implementation of digital developments and innovations, complementing traditional farming methods. This review analyzes how these technologies can be used to solve specific problems in agriculture, particularly in the areas of precision farming, the customization of agricultural machinery and processes, and the modernization and repair of equipment. The use of 3D printing not only increases the efficiency of agricultural work, but also opens up new opportunities in agriculture due to the integration of the Internet of Things and the principles of precision farming. The novelty and scientific significance of this review lie in the systematic comparison of three scientific areas — additive technologies, chemistry/materials science, and agricultural practices — in a single interdisciplinary context. For the first time, additive manufacturing is considered not as an auxiliary technology, but as a cross-cutting tool for the digitalization of the agricultural sector, shaping new approaches to sustainable production, resource efficiency, and environmental safety. The practical importance of the analysis lies in demonstrating specific solutions and examples applicable in real farms: from local repair and customization of equipment to the creation of biodegradable sensors, water and soil monitoring devices, microfluidic analyzers, and robotic nodes. The review is intended for a wide audience, including chemists, materials scientists, agricultural engineers, researchers, and managers involved in sustainable development issues. The analysis highlights the important role of chemistry and materials science in designing solutions that expand the application of additive technologies in agriculture.

Bibliography — 278 references.

## **Industrial and laboratory production of acetylene: world experience and prospects of plasma-chemical technology**

**RCR5201**

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Today, there are three important trends in the chemical industry worldwide: the revival of acetylene chemistry, development of a fundamentally different approach to the processing of coal as a chemical raw material, and elaboration of environmentally friendly industrial processes. One such process is plasma-chemical production of acetylene from coal, which is analyzed in the review in comparison with other processes, both existing and prospective ones. The review also explores the modification of some known industrial processes with the goal to improve the environmental performance without compromising the economy and describes recently discovered methods for utilization of industrial waste from PVC production, which could potentially form the basis for future processes in acetylene chemistry. The performed analysis allows the authors to give recommendations for implementation of the most effective and environmentally friendly processes for acetylene production in industry, considering the current economic and environmental situation in Russia and in the world.

Bibliography — 166 references.

## **Modification of black phosphorus with metal substrates: towards single-atom catalysts**

**RCR5204**

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Owing to its unique anisotropic structure, high charge carrier mobility, and tunable bandgap, few-layer black phosphorus (FLBP) emerges as a highly promising material for applications in micro- and optoelectronics, energy conversion, and catalysis. Chemical functionalization and structural modification of FLBP not only enhance its ambient stability but also enable precise tailoring of its electronic and catalytic properties. This review systematizes state-of-the-art methods for the synthesis of FLBP and its surface modification using metal substrates. Special emphasis is placed on the fabrication strategies of 0D/2D FLBP-based nanocomposites decorated with transition metal nanoparticles, the modification of FLBP with single metal atoms, and the application of these materials in electrocatalytic and photocatalytic processes, including the hydrogen evolution, CO<sub>2</sub> reduction and nitrogen fixation. In conclusion, the key challenges and future research directions in the development of novel FLBP-based catalytic systems for practical energy and environmental catalysis applications are outlined.

Bibliography — 214 references.