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Editorial

Electrochemical Technology for New Materials Synthesis and Reprocessing

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It is difficult to underestimate the role of electrochemistry in the modern world. High-temperature technologies are essential for technological progress in the 21st century. New materials with desired properties for the development of electronics, power industry, and industrial engineering; the development of electrochemical energy, providing the most efficient conversion of chemical energy to electrical energy; as well as technologies for the recycling and conversion of natural materials and manmade waste, including spent nuclear fuel, using electrochemical methods are the basic tasks of electrochemistry.

The articles presented in the Special Issue "Electrochemical Technology for New Materials Synthesis and Reprocessing" provide a vast array of experimental, theoretical, and analytical research related to three above-mentioned basic electrochemical areas.

Experimental studies on the formation of intermetallic compounds of rare earth elements with unique physical–chemical properties, including high catalytic and sorption activity, effective magnetic characteristics, and increased heat resistance, are presented in the papers by Kushkhov et al. The mechanism of nickel, cobalt, iron, and holmium co-reduction in the equimolar KCl-NaCl melt is presented in [1]. Additionally, the electrochemical behavior of dysprosium ions and their co-electroreduction with nickel ions in the molten KCl-NaCl-CsCl eutectic are analyzed in [2].

The method of eletrodeposition may be successfully used to synthesize oxide tungsten bronzes from polytungstate melts. These non-stoichiometric compounds have a wide variety of optic and electrophysical properties and may be used in electrochromic, biomedical, and field emission applications. The properties of oxide tungsten bronzes depend greatly on the composition of their components. The experimental results on the synthesis of tungsten bronzes and the calculation model of the Na_2WO_4–WO_3 melts' ionic composition are provided in the study.

Electrolysis in molten salts allows for the acquisition of pure metals, metallic coatings, and powders with desired properties. Rhenium is one of the most widely used rare earth metal in a number of industrial fields. Rhenium can be obtained through the electrolysis of rhenium-containing compounds in molten salts. Chernyshev et al. [3] presented the experimentally obtained density temperature dependences and liquidus temperatures of KF–KBF_4–B_2O_3–$KReO_4$ melts as promising stable sources for metallic rhenium production.

The development of new materials for highly efficient electrochemical power sources and the analysis of their properties are also considered in the papers included in this Special Issue. Ceramic materials based on the layered perovskite $BaLa_2In_2O_7$ with Ga dopants were obtained and investigated for the first time in [4]. Tarasova et al. revealed the effect of dopant concentration on hydration processes and ionic conductivity. The rare earth doping of layered perovskites was found to be a promising approach for the design of ceramics for electrochemical energy-generating devices.

The study [5] is focused on the effect of cation non-stoichiometry in $Sr_xZr_{0.95}Yb_{0.05}O_{3-\delta}$ oxides on the proton and ionic conductivities to obtain highly efficient new proton-conducting solid electrolytes. These oxides are considered as promising electrolytes for applications in proton-conducting ceramic fuel cells owing to their high ionic conductivity and chemical stability.

Research related to molten salt reactors attracts considerable attention in the scientific community. The possibility to determine small concentrations of oxide ions in chloride melts is illustrated in the example of the $PbCl_2$-PbO system. The results of such studies are of great scientific interest for a number of technological processes.

The paper by Arkhipov et al. [6] provides thermodynamic data for the metal/FLiBe system. These data provide an understanding of the metal behavior in fluoride melts and provide practical guidance when choosing appropriate construction materials to be used in molten salt technologies, as well as for the electrolytic production of metals and the design of molten salt reactors.

The research results presented in the present Special Issue are highly relevant and interesting both for industrial applications and theoretical studies, such as new, beneficial methods for novel materials production and the development of technologies of hydrogen, atomic, and distributed energy generation, which are among the key issues of modern science.

Conflicts of Interest: The author declares no conflict of interest.

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