- **Organization:**

  Science&Educational Centre "Nanomaterials in Accumulation and Generation Energy Devices" at the Vasyl Stefanyk PreCarpathian National University
- **Legal status legal entity – University**
- **FP's experience -**

FP7 Research Area
Energy, NMP

Keywords
Electrochemical sources, Lithium Battery, renewable energy devices, nanoparticles.

Title of the proposed projec]

Lamellar Nanosized Particles of Milk Magnesia: Preparation and Electrochemical Properties by the Lithium Battery Example

Project description

Introduction

In accordance with the general usage of structural signs the most suitable for the intercalated processes of current-generating are materials that have specific, namely the layer structure.

Known among such materials are a graphitizing carbon, natural and synthetic talc, chalcogenide metals.

At the search of more cheap and ecologically safe for a man and environment of electrode materials comes into on itself a notice $Mg(OH)_2$ – magnesium hydroxide in other words milk magnesia that has the layer structure also.

Main Advances:

The main mechanisms of obtaining magnesium hydroxide, using the method of product sedimentation as a result of the reaction interaction of the solutions of magnesium-bearing salt NaOH, were ascertained.

Novel aspects thermal dehydration of $Mg(OH)_2$: the characteristics of the surface hydroxyls as well as of the bulk MgO bonds depend on heating conditions, as noticeable changes are observed in the XRD patterns and the IR spectra of the samples undergoing the mentioned transformation of phase $Mg(OH)_2 \rightarrow MgO_x \rightarrow MgO$.

Natural bischofite $MgCl_2 \cdot 6H_2O$ was used as magnesium-containing precursors.

The electrochemical lithium ion intercalation to the cathode material of the galvanic source formed on the basis of the disperse magnesium hydroxide with nano-matrix scale particles was studied. Experimental samples of $Mg(OH)_2$ differed from each other in the particle sizes, shapes, and structural parameters. They were obtained with the help of the precipitation method using crystalline hydrate $MgCl_2 \cdot 6H_2O$ and salt $NaMgF_3$ as a magnesium-containing precursor.

It is found out that the current-generating process in such sources is based on the insertion of lithium ions into the structural channels of magnesium hydroxide and on their substitution of protons of hydroxyl groups.

The influence of the morphological condition of magnesium hydroxide particles on the current-generating process was discovered.

Only the cathode material on the basis of the lamellar particles demonstrates the nominal specific power capacity of 872 $mA \cdot h \cdot g^{-1}$ when the discharge of the source is up to 1,5V. The specific energy capacity of the sources with the cathodes on the basis of thin flaky $Mg(OH)_2$ particles and tubular $Mg(OH)_2$ particles formed out of them is much lower and is 344 $mA \cdot h \cdot g^{-1}$ and 229 $mA \cdot h \cdot g^{-1}$, respectively. The low energy capacity of the cathodes produced from these materials is connected with the morphology of $Mg(OH)_2$ particles, which conditions their unfavorable orientation in relation to the anode.

The priority fixation of Li^+ ions with acid chemisorbed carboxyl bunching on the developed surface of the flaky and tubular particles facilitates the formation of the passivating lithium overcoat, which causes the sharp decrease in the electromotive force of the galvanic source.

Areas of Application

Presented nanotechnology is the way to preparation of synthetic milk magnesia as multifunctional material. It is possible it will be used above all things as electrode material of lithium battery, and also in qualities of absorbent, flame retardant filler of heat-insulation polymeric materials, at making of heat-resistant ceramics or special sorts of cement.

Budget estimation (EUR) **400 000 EUR**

Key partners already involved

Heijlundzjanj Technical University (Harbin, China)
Lublin Technical University (Lublin, Poland)
National Uniersity 'Lviv Polytechnica' (Lviv, Ukraine)
G.V. Kurdyumov Institute of Physics of Metals NAS of Ukraine (Kyiv, Ukraine)

Profile of a partner

Type of organization

+ [Research organization]
+ [University (High School)]
+ [Industry]
+ [SME]
□ [Regional authority]
□ [Other]

Partner's role in the project

1) **[Administrative Coordinator]** **or**
[Scientific Coordinator] **or**
[Partner]

2) **[Research]**
[Technology development]
[Training]
[Demonstration]
[Dissemination]

[Country preferred]
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