РОССИЙСКАЯ АКАДЕМИЯ НАУК
Учреждение Российской академии наук
УРАЛЬСКОЕ ОТДЕЛЕНИЕ РАН
(УрО РАН)
Первомайская ул., д. 91,
Екатеринбург, ГСП-169, 620041
Тел. 374-02-23, факс 374-41-33, 374-07-81
E-mail:document@prm.uran.ru

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На № _____ от _____

Директору Института химии твердого тела УрО РАН

члену-корреспонденту РАН В.Л. Кожевникову

О сотрудничестве с компанией Samsung Electronics Ltd.

В соответствии с положениями рамочного соглашения о сотрудничестве между РАН и компанией Samsung Electronics от 2002 года данная компания обратилась в Отдел внешних связей УрО РАН с просьбой проинформировать научные учреждения УрО РАН о старте новой программы компании Samsung по поддержке научно-исследовательских проектов GRO (Global Research Outreach). Согласно этой программе на исследовательский проект может быть выделено 50 000 – 100 000 долларов США длительностью до 3 лет.

Темы, по которым могут подаваться проекты, и форма предоставления проекта даны в приложении.

Просим Вас дать информацию в отдел внешних связей УрО РАН по следующим вопросам:

- есть ли у института заинтересованность в сотрудничестве с компанией Samsung Electronics;
- есть ли в институте разработки по запрашиваемым компанией темам;
- есть ли намерение у института подать заявку на проект.

?! ✓

Срок подачи заявки 1 ноября 2009 года. Контактное лицо: главный специалист ОВС УрО РАН Деева Тамара Васильевна, тел 362-33-23, E-mail: deewa@prm.uran.ru.

Сотрудничество между Российской академией наук и компанией Samsung Electronics происходит в рамках трех соглашений: рамочном (2002 г), о совместном патентовании (2004 г.) и о совместных научно-исследовательских работах (2006 г.).

Приложение: на 6 листах.

Начальник Отдела внешних связей
Уро РАН А.В. Сандаков

Канцелярия
института химии твердого тела
УрО РАН 4/94
Вх. №
От "19" 10 2009 г.

Subject 9: Combinatorial Search and Development of New Non-Pt Composition for Oxygen Reduction

Introduction

The important hurdles of commercialization of fuel cell, especially, proton exchange membrane fuel cell (PEMFC) are cost and durability of the system. In a view of the cost, the Pt and Pt alloy catalyst, which used mainly in the current technology as catalyst forward hydrogen oxidation and oxygen reduction reactions, is considered as the primary target to reduce or replace because Pt is a precious metal and very expensive. However, it is very difficult and tedious to find new composition having comparable catalytic activity to the Pt and Pt alloy catalyst by conventional trial-error approach.

Thus, SAIT is interested in the search and development of non-Pt catalyst compositions for the oxygen reduction reaction under fuel cell operation conditions by recent combinatorial and high-throughput detection method. We also interested in search of the non-Pt catalyst and/or understanding and prediction of catalytic activity forward oxygen reduction reaction based on the quantum calculations using d electron density and surface energy of metal element.

Scope

The scope of this subject is to search the non-Pt composition having comparable catalytic activity for oxygen reduction reaction under acid conditions by the combinatorial and high throughput methods based on the prediction or simulation from the quantum mechanical calculation.

- Search of the non-Pt composition for oxygen reduction reaction in the acid condition by combinatorial and high-throughput methods
- Search of the non-Pt composition and prediction of oxygen reduction reactivity based on the quantum calculations

Research Questions

Additionally to the above research scope, we have special interests in the following questions. Any research participation or open discussion will be welcomed.

1. What would be the best method to predict the oxygen reduction reactivity of catalytic composition?
2. How to simulate the oxygen reduction on the catalyst surface?
3. What would be the best method for high throughput detection of catalytic activity for oxygen reduction?
4. How to apply the combinatorial method to find the new compositions?

Expected Deliverables

Deliverables can be non-pt composition for oxygen reduction reaction, method to find the composition, reports for describing the methods and results.

Proposal Format

Proposals are expected to provide answers, in English, to the following questions. Proposals should be no longer than 10 pages, not counting appendices, if included.

PART 1 : Proposal Identification

- ☐ Title of Proposal
- ☐ 2009 SAIT GRO Project Subject and Subject Number
- ☐ Principal Investigator("PI") Information : Enter Name of PI, Name of University, Department, Mailing Address, Phone number, and e-mail address
- ☐ Co-PI Information (if applicable) : Enter Name of Co-PI, Name of University, Department, Mailing Address, Phone number, and e-mail address

PART 2 : Project Summary (Approximately 1 page)

- ☐ Please provide executive summary

PART 3 : Description of Project

- ☐ Project Duration
- ☐ Research Objectives
- ☐ Significance of Research
- ☐ Research Plan and technical approach
- ☐ Milestones and Expected Outcomes

PART 4 : Resources

- ☐ Personnel, equipment, or facilities
- ☐ External Funding, if applicable

PART 5 : Budget (in US$)

- ☐ Direct expenses
- ☐ Indirect costs

2009

Samsung Advanced Institute of Technology ("SAIT")
Global Research Outreach Program ("GRO")
Research Subject Descriptions

SAIT invites novel research ideas in SAIT's broad industry presence and research field.
University researchers are invited to address specific research subjects.
The research subjects for the 2009 SAIT GRO Program are detailed below.

Computing & Intelligence	• Real 3D Display Architecture and Processing • Cognitive computing based on neuromorphic approach • Cloud Computing • Multicore Software Solutions and Tools
Comm. & Network	• Group Key Agreement (GKA) and ID based Cryptosystem for the support of Wireless Mobile Virtual Private Communities
Display	• Light Emitting Device
Nano Electronics	• Nanostructured Bulk Materials
Energy & Environment	• Lithium-ion battery new cathode or anode material • Combinatorial Search and Development of New Non-Pt Composition for Oxygen Reduction
Bio & Health	• Nano-Bio Sensor Development for In Vitro Diagnostics

Subject 7: Nanostructured Bulk Materials

Introduction

The goals of SAIT research in nanostructured bulk materials is as follows:

(1) Meet the unmet needs (Innovative property development of known materials)
(2) Break the fixed link between materials and needs (Extraction of new functions)
(3) Prepare the unknown needs (Investigation of new materials with extreme properties)

In "meet the unmet needs" we are aiming at improving the functional properties of materials currently being used in industries to enhance the materials efficiency and/or broaden their applications. In this area, we are required to control five main properties (electrical, thermal, mechanical, magnetic, optical properties) of materials by nanostructuring.

Another area of research, "break the fixed link between materials and needs", focuses on boundless research on any known materials for unexpected functions to replace commercial materials and/or enter the limited boundaries resulting from their intrinsic properties (e.g. organic-like inorganic for high temperature applications).

"Prepare the unknown needs" is focused on developing new materials with more than one unusually high functional property. Research in this area must ensure that methods are applicable to many kinds of materials.

Scope

Research proposals may either help develop the techniques being applied to these problems or investigate alternative approaches.

Research Questions : Specific topics of interest include

1. Synthesis and processing of nanostructured powder
   - nanosize powder
   - nanostructure embedded powder
   - powder with nanopore
   - coating
   - nanowire

2. Processing of nanogranule
   - nano-level mixing, dispersing, and bonding

3. Heat treatment for nanostructured bulk
   - growth process
   - grain-boundary/interface reaction and diffusion control
   - nano-level region composition control
   - hetro-structuring
   - low temperature heat treatment

- nanopore formation

4. Deformation and damage process for nanostructured bulk
   - textured structuring
   - nano-fiber assembly bulk

5. Processing for nanostructured bulk
   - locally superlatticed nanocomposite
   - nanotube/nanowire templated bulk

Subject 8: Lithium-ion battery new cathode or anode material

Introduction

Electric vehicle is one of the high technologies which can reduce the green house gas, lower the dependence on fossil fuel and lead to green energy era. EV technology is continuously evolving from HEV(Hybrid Electric Vehicle) to PHEV(Plug-in HEV) and BEV(Battery Electric Vehicle). The most important technology on this evolution is the rechargeable battery technology.

Energy of the battery should increase 5 to 10 times during the evolution from HEV to PHEV and BEV. Battery's portion of weight, volume and cost in EV is continuously increasing and accordingly requirements of battery's energy density and cost is getting severe. Although Ni-MH batteries have been mainly adopted in HEVs, Lithium-ion batteries(LIBs) which excel Ni-MH in energy density will be mainly adopted in PHEVs and BEVs.

LIB is the proven technology in the mobile IT applications but much higher level of performance is required for EV application especially in cost, safety and durability. Accordingly battery materials e.g. cathode/anode active materials which has been proven reliable in mobile IT application are considered first in EV application. However the existing materials have limit on energy density and this limits the driving range of the electric vehicle.

In order to enable the BEV which will have the driving range of 200 kilometers by 2020, the battery energy density of 250Wh/kg is needed according to the roadmap of Japanese NEDO(New Energy Development Organization) project and this is considered as the limit of LIB. This target is quite high seeing that the energy density the battery which is adopted in GM Volt is about 90Wh/kg. This means that totally different materials than the existing materials e.g. lithium transition metal oxide or graphite are needed.

Scope

The scope of this subject is new cathode or anode material which enables high energy density of lithium-ion battery for EV application.

Research Questions

To be specific, cathode materials having gravimetric capacity over 200mAh/g and anode materials having gravimetric capacity over 500mAh/g are favorable. Of course, other characteristics which are necessary for EV application like low cost, good safety, long life and acceptable power capability are also needed.