Subject	**Invitation to review grant proposal for the National Science Center, Poland**
From	National Science Centre, Poland <osf_administracja@opi.org.pl>
To	<equiroga@ifuap.buap.mx>
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Date	2021-12-01 13:54

ID: **529986**
Funding scheme: **SONATA BIS-11**
Panel: **ST5 (Materials)**
Institution: **University of Warsaw**
PI: **dr inż. Dominika Buchberger**
Title: **Development of a procedure using in-situ and ex-situ methods to analyze electrode material properties over lithium-ion battery cycles. (Opracowanie procedury wykorzystującej metody in-situ i ex-situ do analizy właściwości materiałów elektrodowych podczas cyklowania baterii litowo-jonowych.)**

Enrique Quiroga-Gonzalez

Dear Colleague,

On behalf of the National Science Centre Poland I would like to invite you to review the above-mentioned research proposal which was submitted to the National Science Centre (http://www.ncn.gov.pl). This review is a part of the second stage of our merit-based evaluation process.

The proposal is written in English and the review needs to be written in English, too. The application consists of a detailed description of the research project (up to 15 pages) and information on: research tasks, research team, scientific achievements of PI and budget summary. Below you will find the proposal abstract. Full access to the content of the proposal and evaluation form is available after accepting the invitation in the electronic system.

If you are willing to review the proposal, please click on the link https://osf.opi.org.pl and log in or generate login data by clicking "Get login and password" (under the Password Box). **If you are a new user** please keep in mind that the OSF system will recognize you only under this address equiroga@ifuap.buap.mx.

If you are unable to review the proposal at this time, we would highly appreciate your suggestions for alternative reviewers.

We would greatly appreciate if you could let us know within the next **3 days** if you accept or decline the invitation.

Should you choose to accept our invitation, please complete the online evaluation form no later than **22nd December, 2021** using the OSF electronic submission system.

We offer remuneration of PLN 400,00 gross (equivalent to ca. EUR 100 gross) for a completed review of the proposal. The payment will be processed up to 6 months after the submission of the review via bank transfer.

For detailed instructions regarding the use of the login process, ethical issues and principles of evaluation please see Guidelines for Reviewers

Should you have any questions or comments please do not hesitate to contact us.

Kind regards,
Monika Góral-Kurbiel
Scientific Coordinator
National Science Centre
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Abstract:
Lithium-ion batteries are one of the most important energy storage systems. Their development is of key importance for socio-economic and ecological reasons. One of the crucial research areas in the field of Li-ion batteries is an improvement of electrode materials in terms of their stability and hence the battery safety and durability. The stability of the electrode materials is closely related to their crystal structure and the cyclability impact (mechanism of charging and discharging processes) and thus the structural changes within the electrode material as well as the electrode layer. To track these problems structural and morphological studies have to be applied. The most advanced and straightforward methods are in-situ and ex-situ studies which can be operated using various techniques. This project focuses on non-invasive, highly responsive, and sensitive measurements using Raman microspectroscopy, X-ray diffraction, and electron microscopy. Each of those techniques will give unique information on the changes occurring at the electrode side during or after battery testing. In situ Raman method will provide local structural information on a single grain of the electrode material through the electrochemical operation, whereas ex-situ measurements will give an opportunity to distinguish structural and morphological changes at a particular state of charge or discharge more comprehensively. Ex-situ Raman spectroscopy will be used to create spectral maps of the chosen electrode area (including cross-sections) and provide great statistical data on structural changes within the electrode surface and bulk. The ex-situ XRD method will allow tracking a full set of crystallographic parameter variations across the different states of charge and discharge and will help to accurate the spectral data description. Ex-situ electron microscopy data with elemental analysis will show the microscopic picture of the electrode changes such as deformations, damages, cracks, precipitations, etc. Several classes of materials will be studied during this project including (but not limited to) layered oxides, spinels, and olivines. All those types of electrode materials are considered the most promising ones in terms of the novel LIB designs for future applications and thus need the most demanding examinations. The materials will be synthesized using commonly known routes such as wet chemical, solvothermal or solid-state methods. Before performing more sophisticated examinations, the materials' quality will be confirmed using basic structural, morphological, and electrochemical data. Confirmed samples will be subject to in-situ and ex-situ examinations. In-situ Raman will be performed in a specially dedicated electrochemical cell and the first few cycles, as well as the cycle after long-term examination, will be studied. Ex-situ tests will be implemented on the pre-prepared samples: electrochemically examined and left at the particular state-of-charge or -discharge, and then specially pretreated before further handling. After collecting structural and morphological data, the advanced data analysis will be performed to describe the changes and anomalies within the cycled electrodes based on their electrochemical history. Only a complex study can answer all questions regarding stability and battery safety problems such as: what is the reason for electrode failure? what is the mechanism of the electrochemical reaction and electrode decomposition? what are the limiting potential value and correct charging strategies for specific electrode materials? The proposed research and analysis will cover detailed structural and morphological changes during battery operation like so-called electrode formation mechanism, long-term cycling issues in connection to the applied current rate, determination of safe operational electrochemical window and charging practice, stability of electrode structure, and possible decomposition mechanisms, electrode-electrolyte interactions, etc. This research will lead to the development of a novel analytical procedure that could be applied in the battery "health" diagnostics through a rapid in situ Raman method inside the cell. This complementary research will give a full picture of the material stability and battery safety issues and will provide fundamental, but typically overlooked, answers alongside popular fast-paced research for the best performing battery.

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