**Brief information about the project**

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| Name of the project | AP09260371 «Understanding of the mechanism of modifying coatings influence of the sodium-ion battery cathode active material on the intercalation kinetics» |
| Relevance | The majority of cathode materials used and developed in metal-ion batteries represent a poorly conducting phase which prevents the charges transfer in electrochemical process. This leads to low power rates and decreased cycling efficiency. To reduce this effect, the coating of particles of electroactive material with a layer of an electronic conductor is widely used, which ensures charge delivery to any point on the surface. Sometimes it is not enough to solve the problem since the electrochemical transformation during intercalation also requires transfer of cation and transport charges inside the phase. In this regard, detailed examination of the nature of the processes during intercalation into poorly conducting materials is absolutely necessary to increase the efficiency of electrode materials' researches. |
| Purpose | The aim of this project is to reveal the influence of the properties of the modifying surface coating of poorly conductive cathode active materials on the processes of charge transfer through it during reversible intercalation of the material phase, also to develop a model of this process and its modeling. |
| Objectives | A comprehensive electrochemical study of the intercalation and deintercalation kinetics process will be carried out for different variants of the implementation of the particle coating and the characteristics of the conducting layer or the phase in contact with the material. Also, the modeling of these processes will be done. The data obtained in the experiment will be compared with the data obtained from modeling.<br><br>To achieve this goal, the solution of 3 main tasks is required.<br><br>The first is the synthesis, characterization, and study of the kinetic regularities of the intercalation-deintercalation of sodium in polysulfate and polyphosphate cathode materials without special methods of forming a conductive coating.<br><br>The second is the selection of materials and the development of methods for applying electrically conductive coatings on particles of active material.<br><br>At third we will the study of the kinetic consequences of the functioning of conducting coatings and the formation of theoretical concepts of the process. |
| Expected and achieved results | At the culmination of the project, a comprehensive model detailing the intercalation-deintercalation dynamics of sodium ions within poorly conductive polysulfate and polyphosphate cathode materials for sodium-ion batteries, incorporating electrically conductive coatings, has been unveiled. The anticipated outcomes of this investigation illuminate the pivotal |

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| | role played by conductive coatings in facilitating the sodium intercalation-deintercalation processes within cathode materials. This elucidation promises to address the longstanding challenge of insufficient conductivity inherent in polyanionic materials, thereby enhancing their capacitive performance, particularly under high charge-discharge currents. The innovation in developing competitive cathode materials for sodium-ion batteries is poised to drive down the overall cost of electrochemical energy storage and curb the reliance on lithium-based natural resources. |
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| List of publications with links to them | |
| Patents | |

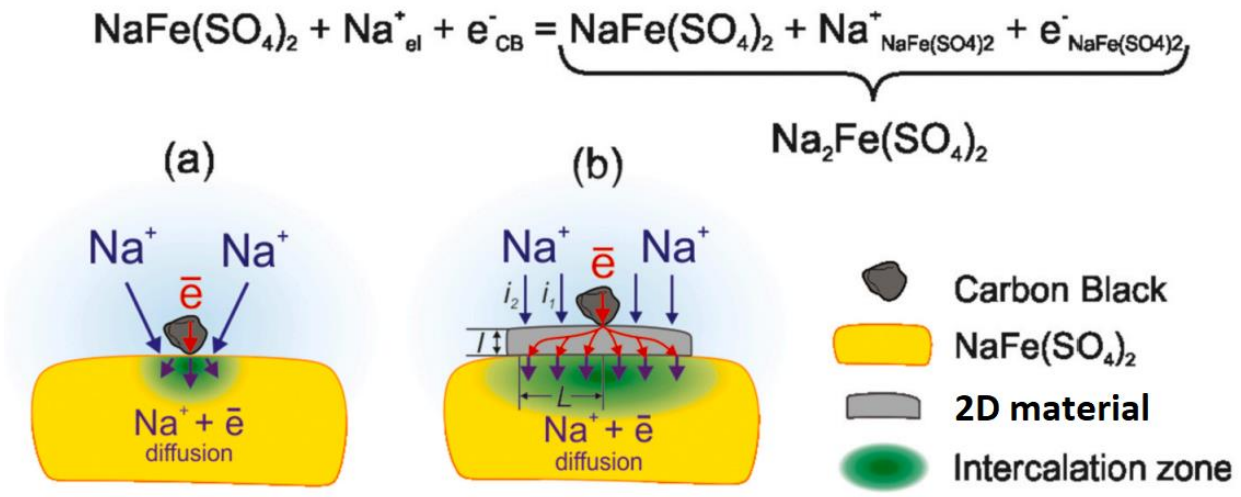


Figure 1 Representation of sodium intercalation in NaFe(SO4)2 and the formation of electrochemically active zones upon contact of the active material with electrically conductive particles of different nature and morphology

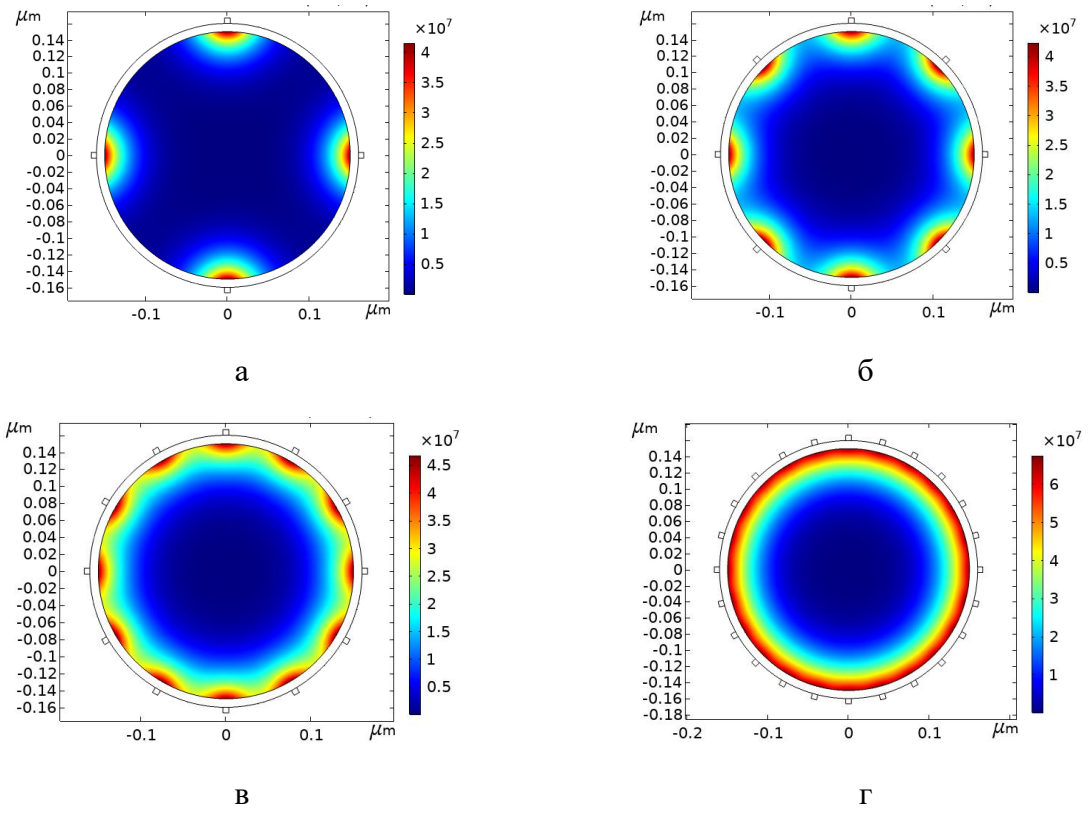


Figure 2 - model - distribution of concentration of the intercalated phase for different numbers of carbon contacts on the coating