Due to climate changes, it is inevitable to rationalise energy resources. Thus, in recent years, there has been a rapid development of scientific fields concerning efficient accumulation and releasing of energy, which should enable efficient use of renewable energy sources. This results in searching for improved energy conversion and storage devices, that are based on readily available and cheap materials. The presented project fits perfectly into these needs.

The project aims to develop, synthesise and characterise new composite electrode materials for high-efficiency sodium-ion cells. Sodium is one of the most abundant elements on Earth, which makes it a desirable alternative to lithium in energy storage devices. It is well known that lithium is a non-abundant element, limited to only 20 ppm in earth's crust. However, cobalt, commonly used in cathode materials of Li-ion cells, is a larger problem regarding availability (25 ppm in earth's crust) and geopolitical aspect. Sixty-two percent of the world's cobalt comes from the Democratic Republic of Congo and a significant portion of cobalt production in the Congo violates human rights and child labour laws, as a 2016 Amnesty International report, "This Is What We Die For," documented all too well. Moreover, 90% of the cobalt extracted in Africa is exported to China.

The project includes studies starting with novel and facile methods of synthesis of the composite cathode and anode materials, with increased electrical conductivity and better electrochemical stability. Proper optimisation of synthesis conditions should ensure appropriate chemical composition and structure of new materials to provide high electric capacity and increased stability during multiple charge-discharge processes. Achieving these goals will be possible through the detailed physicochemical and structural studies (using many spectroscopic techniques), combined with insightful electrochemical characteristics of the obtained materials, that is planned in the project. The project assumes the creation of a unique station for single particle electrochemical measurements on microelectrodes in non-aqueous electrolytes. These measurements will help to understand the mechanisms of charge storage in the new electrode materials.

The knowledge and experience in materials engineering and electrochemistry, as well as access to highly specialised equipment, is required for the successful realisation of the project goals. This is possible thanks to cooperation and combination of experience of specialists from three centres: Gdańsk University of Technology, Nicolaus Copernicus University and Technische Universitaet Darmstadt. The proposed cooperation generates enormous benefits for the partners, and none of the teams can alone achieve the project objectives.

Developing new, compatible, high capacity electrode materials for sodium-ion batteries in line with recognising and proposing the efficient solutions to counteract their drawbacks will be a milestone for the potential application of stable sodium ion batteries.