Nowadays, there is no doubt that lithium-ion batteries (LIBs) dominate the consumer electronics and electro-mobility areas due to their special features such as: high energy density, good performance, long cycle life, low weight and small size. Taking into account the permanent growth of the LIBs application in the global markets, the battery development in the 21st century need to be targeted on green production process as well as sustainability with respect to operational parameters and safety issues. Therefore, even Li-ion technology requires constant improvement especially by using novel, low cost, environmentally friendly and more efficient materials [1,2].

One of the distinguished direction in Li-ion batteries research is the application of carbon aerogels as anode materials. The reason is that carbon aerogels exhibit many extraordinary properties e.g. large surface area, chemical and thermal stability, determined porosity, high electrical conductivity and high capacity [3]. However, the commonly used carbon precursors for their preparation (e.g. formaldehyde, cresols, isocyanate) are still toxic and rather costly [3-5]. Thus, to promote the principles of green chemistry in pursuit of global energy sustainability, the current studies on carbon aerogels are concentrated on finding innovative, non-expensive, renewable, accessible and more friendly carbon precursors that make these materials competitive not only in terms of their properties but also in the context of economics and ecology. All things considered, the application of starch seems to be one of the better choices. Starch is available, renewable and cheap biopolymers that consists of two glucose polymers: amylose (linear polymer) and amylopectin (branched polymer). Because of this, starch occurring with natural inhomogeneity [6] what translates into different electrochemical properties and morphology of obtained carbons. Moreover, these bio-derived aerogels represent much better electrochemical parameters than graphite- higher specific capacity, and the possibility of working properly under high current loads [7-10].

Although the amorphous carbons derived from starch are one of the promising candidates for Li-ion battery application [7-10], the main issue preventing their commercialization is their huge irreversible capacity during the initial cycling. The capacity is one of the basic parameter which determines the quantity of accumulated charge in the cell. The higher the capacity is, the more energy can be stored in Li-ion battery. In order to use the maximum amount of available charge, it is need to achieve a reversibility during charge and discharge processes. However, the lithium consuming parasitic reactions (such as: the irreversible reaction of Li^+ with functional groups on the carbon surface, or the irreversible insertion of lithium ions, that can be trapped into closed micropores in the carbon matrix) result in the active lithium losses which are clearly visible in the 1st cycle of working [11-12]. Due to the fact that this problem is extremely important and concerns all carbon anodes to a greater or lesser extent, the purpose of the project is a fundamental and comprehensive research dedicated to dealing with this issue. Hence, as a result of these studies the synergic effect of 1) novel electrolyte additive application, 2) surface modification of studied aerogels and 3) lithium doping into the carbonaceous structure will be established. It is assumed, that this complex strategy will reduce the parasitic reaction of lithium, allow to keep control over the process of better and more stable passivation layer formation (on the carbon surface) and also give a possibility to the additional compensation of active lithium loss by lithium -doping. By doing so, this project will contribute to the increase of human knowledge, to the development of energy storage technology as well as to the promotion of the economic growth in the future.

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