The goal of the project is to develop a new approach to enhance the long-term reactivity of multicomponent materials working as catalysts in the electrochemical water-splitting reaction. The motivation to undertake research is the growing demand for energy and at the same time a need for increased environmental protection. Hydrogen produced in the process of water electrolysis is a potential fuel for environmentally friendly energy cycles. The electrolysis of water for hydrogen production is one of the easiest and cleanest ways to store on a large scale and for a long time a significant amount of energy from renewable sources (wind, waste heat, sun, etc.). Catalytic systems composed of abundant elements are very likely to provide a radical reduction in costs and allow the use of this technology on a massive scale. Unfortunately, effective water electrolysis is still limited, above thermodynamic requirements, by the slow oxygen evolution reaction. Oxide and hydroxide transition metal materials can act as extremely effective catalysts for the oxygen evolution reaction, and moreover, also in the hydrogen evolution reaction, in electrochemical decomposition of water under basic conditions. Water electrolysis, which is a redox reaction - products have different oxidation levels than substrates, occurs over two electrodes. One of them, the cathode, produces hydrogen, and the other, the anode, produces oxygen. It is this second reaction that is slower and limits the reaction rate - efficiency - of the whole process. The investigated composite materials will consist of nitrogen-doped carbon materials and phosphorus promoted hydrated transition metal oxides. The research hypothesis assumes that the obtained composite materials will benefit from the high electrocatalytic activity of the oxide phase forming the shell of the carbon component, which in turn will provide an increased surface area for active phase exposure and high electrical conductivity. Thanks to this catalytic system configuration, electrons released in the process of oxygen evolution can be effectively delivered to the process of hydrogen evolution. An important function of the oxide layer will be to shield the carbon core from excessive oxidation, thus protecting the composite material from degradation. The combination of modern synthesis methods to produce composite electrocatalytic materials and studies of their structural changes during long-term operation will provide new knowledge about the active phases responsible for their reactivity. The expected results will enable understanding of the system at the fundamental level and will create a basis for the design of new, multi-component, hierarchical systems with permanent high activity in electrocatalytic reactions. The obtained research results will facilitate the development of new, practical catalytic materials with multifunctional effects.