Sustainable development, which became a priority for many highly industrialized countries at the turn of the 21st century, will not be possible without solving the issue of energy storage. One of the most promising solutions to this problem entails the use of solid oxide electrolyzer cells (SOECs) to convert excess energy into fuel such as hydrogen via electrolysis. SOECs are constructed by applying the same materials and design solutions used in the case of solid oxide fuel cells (SOFCs). A single cell of these electrochemical devices consists of a cathode, an anode and a solid oxide electrolyte, while the component called the interconnect connects individual cells into stack, allowing the entire device to output a significant amount of power**. However, the reversal of the direction of the electrochemical reaction and the different composition of gas mixtures feeding the system cause cell elements operating in the SOEC mode to deteriorate at a far higher rate.** This is particularly true of those parts of an interconnect that are exposed to the anode side, where very rapid corrosion takes place. Since the operating conditions specific to SOECs – high operating temperatures (above 700°C), a lifespan of up to 40,000 hours, and exposure to an oxidizing-reducing environment – are very demanding, the criteria set for interconnect materials are very strict. These include high chemical stability, resistance to high-temperature corrosion in both oxidizing and reducing atmospheres, compatibility between the thermal expansion coefficients of interconnect materials and other cell elements as well as low area-specific resistance (ASR), which should not exceed $0.1\ \Omega\cdot cm^2$ at any point during the lifetime of the device. There is currently increased interest in metallic interconnects – particularly those made of heat-resistant ferritic steels. Ferritic steels have become popular because they are relatively inexpensive to manufacture and easier to machine than their ceramic counterparts, they have a thermal expansion coefficient that closely matches the coefficients of the other electrolyzer components, and they exhibit high thermal and electrical conductivity. The main issue associated with the use of metallic interconnects based on ferritic steel is the increase in ASR that stems from the formation of a Cr_2O_3 scale on the surface of the steel. The scale itself is characterized by low electrical conductivity. In addition, its formation allows chromium to react with oxygen and water vapour, which contributes to chromium evaporation. As a result, a phenomenon known as "electrode poisoning" is observed and the efficiency of the device diminishes. In order to mitigate these negative effects, the steel may be coated with protective-conductive layers. Many such coatings have been based on manganese-cobalt spinel. However, cobalt is considered carcinogenic, which is why a viable replacement has been sought after. Manganese-copper spinel is a material that seems promising in this regard. Many methods can be used to apply homogeneous and continuous spinel coatings, but electrophoretic deposition appears to be the most suitable for wide commercialization, as it is cheap and allows large-area substrates to be coated on both sides simultaneously. The disadvantage of this method is that it is difficult to obtain compact coatings. However, two-stage thermal treatment may be applied in an attempt to produce coatings with low porosity. The first stage involves the reduction of the components of the coating, while the second stage involves its re-synthesis in air, conducted to densify it. Such treatment is usually carried out in an atmosphere of Ar-10% H_2 mixture under high temperature conditions, which to some extent increases the costs involved. **This research project will focus on the modification of the electrophoretic deposition method for ceramic coatings. This modification will involve the co-deposition of the spinel coating and metallic copper nanoparticles on the surface of ferritic steel.** Until now, work in this area has been aimed at optimizing the parameters of the two-stage thermal treatment. In the proposed solution, the co-deposition of nanoparticles and spinel should allow the production of coatings with the required performance using one-stage thermal treatment at a relatively low temperature. This would make it possible to reduce manufacturing costs. In conclusion, although hydrogen has a chance to become one of the leading energy carriers in the coming years, the production costs of electrochemical energy conversion devices must be sufficiently low, which is a prerequisite for the large-scale commercialization of this technology. One way to achieve this is by reducing material costs, e.g. by using cheaper materials that – when modified – nonetheless exhibit the required properties. One example is ferritic steel with reduced chromium content, modified using an appropriate protective-conductive coating. This project addresses these challenges since, on the one hand, it uses cheaper materials that are commercially available, and, on the other hand, it aims to reduce the cost of modifications that allow them to offer the appropriate performance.