Fuel cells are a promising alternate power source of electricity. Despite of significant improvement that was reached by research throughout recent decades, the technology is not still ready to large scale commercial use. The catalyst of fuel cell (FC) should be still investigated due to fact that the only reliable functional catalyst is Platinum, a noble and expensive metal, which makes the use of this technology not competitive. In this thesis, investigation of Platinum doped ceria catalyst and its modification prepared by physical technique of deposition which is magnetron sputtering is presented. The catalyst was studied using standard surface analytic techniques (PES, SEM, AFM, XANES) as well as electrochemical measurement (CV, PEIS). The principal part of this thesis reports direct analyses of catalyst in fuel cell using an individually designed fuel cell test station. Considering the high power density (PD) about 1 W cm^{-2} and substantially higher specific power per gram of Platinum (SP) 1.6 kW mg^{-1} in comparison with commercial Pt-Ru/Pt-C reference catalyst and additionally the relatively longtime stability, the sputtered Platinum doped cerium oxide based catalyst was found a suitable catalyst for PEM FC. Moreover, possible substitution of Pt and CeO_2 by other elements was shown. Beside of these results, the designs of automatized test station with more technical developments were presented.