This diploma thesis aims at studying a process of hydrogen fuel cell poisoning by molecules of carbon monoxide. Low loading platinum-ruthenium anode catalysts prepared by magnetron co-sputtering were studied. The chemical composition and crystallographic structure of the co-sputtered catalyst were analysed by X-ray photoelectron spectroscopy (XPS), energy-dispersive X-ray spectroscopy (EDX), and X-ray diffraction analysis (XRD). The process of CO poisoning was experimentally studied in half-cell and full-cell setups. Thin film catalysts were extensively studied using the rotating disk electrode (RDE) technique by analysing the desorption response of the underpotentially deposited hydrogen and copper as well as carbon monoxide stripping. Long-term and transient response to CO poisoning was investigated in the full cell setup (fuel cell operando mode) using galvanostatic potentiometry and impedance spectroscopy, respectively. A bifunctional mechanism of ruthenium in platinum anode catalyst was analysed. The mechanism of CO tolerance improvement either through adsorbed OH group formation and a change in electronic structure of alloys was discussed.