Title: Study of metal surfaces in operando conditions by means of near-ambient-pressure scanning tunneling microscopy

Author: Petr Dlabaja

Department: Department of Surface and Plasma Science

Supervisor: RNDr. Peter Matvija, Ph.D., Department of Surface and Plasma Science

Abstract: The thesis covers investigation of monocrystalline surfaces of metals Cu(111) and Pt(111) in high pressures. These surfaces were exposed to oxygen and carbon monoxide gasses of pressures between 1×10^{-10} mbar and 5 mbar. Changes in the structure of the surfaces was monitored using scanning tunneling microscopy, low-energy electron diffraction and X-ray photoelectron spectroscopy.

Acquired results showed that reactive gasses at pressures $\approx$ 5 mbar affect the structure of the surfaces more prominently than the same gasses of lower pressures. The surface of Cu(111) at room temperature and 5 mbar pressure of O_2 strongly oxidized. The surface of Pt(111) at pressure 5 mbar of gass O_2 oxidized only locally, under the influence of the STM tip. Increased pressure of carbon monoxide induces creation of nanometric clusters on the surface of Cu(111), which agglomerate into small islands. These islands are distributed evenly on the whole surface of Cu(111). In contrast increased pressure of carbon monoxide mainly changes the shapes of atomic steps and changes the arrangement of point defects on the surface of Pt(111). Acquired results are in good agreement with results of similar experiments described in literature.

Keywords: STM, LEED, XPS, UHV, near-ambient-pressure, Cu(111), Pt(111)