Appendix - Abstracts of Published Articles

- C.R. Parkinson, M. Walker and C.F. McConville
  "Reaction of atomic oxygen with a Pt(111) surface: chemical and structural determination using XPS, CAICISS and LEED"
  Surface Science **545** (2003) 19-33.

The adsorption of thermally cracked atomic oxygen on the Pt(111) surface has been investigated using X-ray photoelectron spectroscopy (XPS), coaxial impact collision ion scattering spectroscopy (CAICISS), and low energy electron diffraction (LEED). High concentrations of atomic oxygen ($\sim 2\times10^{15}$ atoms cm^{-2}) can be cleanly adsorbed on the Pt(111) surface at room temperature by dosing the surface with externally generated atomic oxygen at relatively low exposures ($\sim$ 50 L). Two states of oxygen are readily resolved by XPS with O 1*s* binding energies at 530.8 and 530.2 eV. These states are assigned to chemisorbed oxygen and to an oxidic oxygen state, respectively. XPS spectra of the Pt 4*f* region confirm the existence of an oxide species with the appearance of a peak at 2.4 eV higher binding energy than the bulk Pt $4f_{5/2}$ peak. Using a combination of angle-resolved XPS, CAICISS, and LEED, evidence is provided to suggest that penetration of oxygen into the surface occurs most likely by an exchange mechanism resulting in the reconstruction of the Pt atoms in the first two atomic layers. On annealing the oxygen covered surface at 500°C the oxidic layer is observed to decompose and a p(2×2)-O reconstruction is observed. A CAICISS study of this reconstructed surface presents evidence in favour of O atoms occupying h.c.p. sites over f.c.c. sites. Low exposures ($\sim$ 5 L) of atomic oxygen result in a sharp p(2×2) reconstruction of the Pt(111) surface and a single species in the O 1*s* spectrum at a binding energy of 530.8 eV. Both the p(2×2)-O overlayer and the oxide species are shown to be extremely sensitive to the electron and ion beam.

- M. Walker, C.R. Parkinson, M. Draxler and C.F. McConville
  "Growth of thin platinum films on Cu(100): CAICISS, XPS and LEED studies"
  Surface Science **584** (2005) 153-160.

  The growth mode of platinum films on the Cu(100) surface up to a coverage of 2.75 ML has been studied using coaxial impact collision ion scattering spectroscopy (CAICISS), X-ray photoelectron spectroscopy and low energy electron diffraction. CAICISS data show the formation of a CuPt alloy at room temperature in the top three atomic layers at sub-monolayer Pt coverage. As the coverage increases up to 2.75 ML the formation of a Pt overlayer is observed in conjunction with the near surface region becoming Pt-rich, indicating the onset of layer-by-layer growth. Subsequent annealing shows a significant migration of Pt into the bulk Cu at a temperature of 300°C. Evidence for a more ordered surface after annealing is also presented.

- L.F.J. Piper, T.D. Veal, M. Walker, I. Mahboob, C.F. McConville, H. Lu and W.J. Schaff
  "Clean wurtzite InN surfaces prepared with atomic hydrogen"
  Journal of Vacuum Science and Technology A **23** (2005) 617-620.

  Conventional methods of surface preparation for IIIV semiconductors, such as thermal annealing and sputtering, are severely limited for InN, resulting in In-enrichment and the introduction of donorlike defects. This is explained in terms of the unusually low Γ-point conduction band minimum of InN with respect to its Fermi stabilization energy. Here, low energy atomic hydrogen irradiation is used to produce clean wurtzite InN surfaces without such detrimental effects. A combination of X-ray photoelectron spectroscopy (XPS) and high-resolution electron-energy-loss spectroscopy was used to confirm the removal of atmospheric contaminants. Low energy electron diffraction revealed a (1×1) surface reconstruction after cleaning. Finally, XPS revealed In/N intensity ratios consistent with a predominantly In polarity InN film terminated by In-adlayers in analogy with c-plane GaN0001-(1×1) surfaces.

- M. Walker, T.D. Veal, H. Lu, W.J. Schaff and C.F. McConville
  "InN(0001) polarity by ion scattering spectroscopy"
  Physica Status Solidi C **2** (2005) 2301-2304.

  The polarity of a wurtzite InN thin film grown on a c-plane sapphire substrate with GaN and AlN buffer layers has been investigated by coaxial impact collision ion scattering spectroscopy (CAICISS). Time of flight (ToF) spectra of He^+ ions scattered from the surface of the InN film were taken as a function of the incident angles of the primary 3 keV He^+ ions. From the ToF spectra, the polar angle-dependence of the In scattered intensity was obtained. Comparison of the experimental polar-angle dependence of the In CAICISS signal intensity with simulated results for the various volume ratios of $(000\bar{1})$-polarity and (0001)-polarity domains indicated that the InN film is approximately 75% In-polarity and 25% N-polarity.

- M. Walker, M. Draxler, C.R. Parkinson and C.F.McConville
  "Characterisation of Pt Deposition on Clean and Oxidised Ni(110) Surfaces"
  Nuclear Instruments and Methods in Physics Research Section B (in press).

  Coaxial impact collision ion scattering spectroscopy (CAICISS), X-ray photoelectron diffraction (XPS) and low energy electron diffraction (LEED) have been used to investigate the initial stages of Pt deposition on clean and oxidised Ni(110) surfaces. Pt deposition on the clean surface led to the formation of a Ni-Pt alloy in the surface region. During the oxidation of Ni(110), (2×1), (3×1) and (9×5) reconstructions were observed. Further oxidation led to the formation of a thick NiO film with a disordered surface. Subsequent Pt deposition led to the formation of a thin Pt film on top of the NiO substrate.

- M. Draxler, M. Walker and C.F. McConville
  "Determination of a correction factor for the interaction potential of He^+ ions backscattered from a Cu(100) surface"
  Nuclear Instruments and Methods in Physics Research Section B (in press).

  We have used coaxial impact collision ion scattering spectroscopy (CAICISS) data collected from 3 keV He^+ ions backscattered from a Cu(100) surface in different azimuthal orientations to investigate the influence of the screening length on CAICISS polar angle scans. We have compared the experimental data to computer simulations generated with the FAN code and found that for our experimental conditions an exceptionally low value of 0.53 was required for the correction factor to the Firsov screening length used with the Thomas-Fermi-Moliere potential. In addition we found that the Ziegler-Biersack-Littmark potential is not applicable, resulting in incorrect peak positions in the CAICISS polar angle plots.

- M. Draxler, M. Walker and C.F. McConville
  "Formation of metallic indium during atomic hydrogen cleaning of InN(0001) surfaces"
  Nuclear Instruments and Methods in Physics Research Section B (in press).

  We have used coaxial impact collision ion scattering spectroscopy (CAICISS), low energy electron diffraction (LEED) and X-ray photoelectron spectroscopy (XPS) to investigate the influence of atomic hydrogen cleaning (AHC) on the composition and structure of MBE grown InN(0001) surfaces. Evaluation of the CAICISS data showed that metallic In droplets formed during non-optimised AHC, while LEED indicated a well ordered surface and XPS revealed residual C and O contaminations. Careful comparison of simulated and experimental polar angle scans of the CAICISS data revealed that the observed polar angle peak at 58° is solely related to the formation of metallic In on the InN surface.

- M. Walker, C.R. Parkinson, M. Draxler, M.G. Brown and C.F. McConville
  "Initial Growth of Platinum on Oxygen-Covered Ni(110) Surfaces"
  Surface Science (submitted).

  The initial growth mode of Pt on the Ni(110)-(3×1)-O and NiO(110) surfaces has been studied by coaxial impact collision ion scattering spectroscopy (CAICISS), low energy electron diffraction (LEED) and X-ray photoelectron spectroscopy (XPS). Prior to Pt deposition, the atomic structure of the near-surface regions of the Ni(110)-(3×1)-O and NiO(110) structures were studied using CAICISS, finding changes to the interlayer spacings due to the adsorption of oxygen. Deposition of Pt on the Ni(110)-(3×1)-O surface led to a random substitutional alloy in the near-surface region at Pt coverages both below and in excess of 1 ML. In contrast, when the surface was treated with 1800 L of atomic oxygen in order to form a NiO(110) surface, a thin Pt layer is formed upon room temperature Pt deposition. XPS and LEED data are presented throughout in order to support the CAICISS observations.
