INVESTIGATION OF GAS SPECIES GENERATED IN THE PHOTOEMISSION SPECTROSCOPY SYSTEM AT THE SIAM PHOTON LABORATORY

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Abstract

This report describes the design of the vacuum system of the photoemission spectroscopy system installed at the first beamline of the Siam Photon Laboratory, and shows the results from the investigation of gas species generated in the system. The base vacuum pressure of the system after the well bake-out processes is approximately 2×10^{-10} mbar. The vacuum pressure increases more than one order of magnitude when there is a linear movement of the sample manipulator or when the UV lamp, the electron gun or the X-ray source is operated. The gas species generated in the system were analyzed by the quadrupole mass spectrometer. Adsorption of the gas molecules on a clean well-defined Ni(111) surface has been observed by low-energy electron diffraction and Auger electron spectroscopy measurements.

Introduction

In the investigation of the electronic structures of surfaces of solids, good vacuum conditions have to be maintained to prevent contaminations on the surfaces. It is well-known that even at the pressure of 1×10^{-6} mbar, residual gases can theoretically form a monolayer of coverage on a clean surface within one second at room temperature assuming that the sticking coefficient equals 1.0 (Hoffman *et al*., 1998). At lower pressures, the time for forming a monolayer of coverage becomes longer. To obtain invaluable information of surfaces, the time required for gases to form a monolayer of coverage must be much longer than the time required for the measurement. Thus the vacuum pressure required for research on the electronic structures of surfaces of solids must be in the range of 10^{-10} mbar or lower. With the current vacuum technology, a base vacuum pressure of 10^{-10} mbar can be produced without great difficulties by reducing the out gassing rate of the chambers and vacuum components (Readhead, 1996; Readhead, 2002). However, it is difficult to maintain the vacuum in any measurement system at this pressure when an excitation source such as an X-ray source, an electron gun or a UV

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