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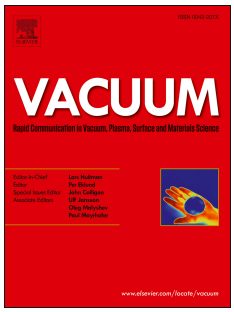

LEIS analysis of the W surface during water vapor adsorption

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LEIS analysis of the W surface during water vapor adsorption

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Abstract

The low energy ion spectroscopy (LEIS) experimental results of the steam adsorption by W samples are presented. It is shown that use of the ion scattering spectroscopy has allowed us to measure the thickness of adsorbate water layer on the tungsten surface with good accuracy. Tungsten at room temperature is completely covered by a water monolayer after 20 minutes (the partial steam pressure $p \simeq 2 \times 10^{-5}$ Pa) of exposure. The water film thickness can be obtained by analyzing energy spectra of hydrogen ions scattering on surface. To transfer the energy scale (in energy spectra) into the depth scale with 10−15% accuracy one can use the approximation formula confirmed by simulation. In these experiments, the water film thickness on W does not exceed 40−45Å.

Keywords: Water adsorption; Ion beam analysis; Low Energy Ion scattering; Thin film analysis

1. Introduction

Water vapor adsorption on the surface is one of the main problems in many areas of fundamental research and applications such as catalysis, electrochemistry, materials science, electronic devices, photo-catalysis and photo-conversion, adhesion, sensors, astrophysics and astro-chemistry [1, 2, 3] , vacuum technology, plasma surface interaction [4] and memristor (memory resistor) technology [5]. The main aims in studying water (or water vapor) surface interactions are to determine whether water is adsorbed molecularly or dissociatively on the surface, the adsorption speed of first layers and first adsorbed water radicals (OH^-, H^+ or $O_2{}^-$) [2]. The difference in chemical properties of these radicals (OH^-, H^+ or $O_2{}^-$) may lead, for example, to surface or bulk oxidation of many materials. In addition, water vapor adsorption on metal surface is quite

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