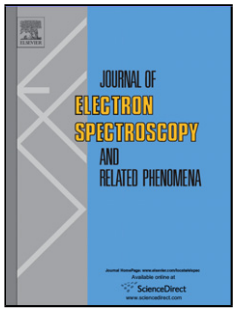

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Author: A. Iwabuchi T. Tachibana T. Hirayama

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Photon-stimulated desorption of Ne metastable atoms from Ar adsorbed on Ne solids

A. Iwabuchi, T. Tachibana, T. Hirayama

Department of Physics, Rikkyo University, 3-34-1 Nishi-Ikebukuro, Toshima, Tokyo 171-8501, Japan

Abstract

We investigated the photon-stimulated desorption of Ne metastable atoms from Ar adsorbed on Ne solids. Desorption was observed even for Ar coverage of 200 monolayers even though the yield decreased with the increase in adsorption of Ar atoms. This result suggests that the mixed Ar–Ne layers formed on the Ne solid via Ar adsorption, instead of the Ar-covered layers. In addition, we found that the kinetic energies of the desorbed metastable atoms depend sensitively on the Ar adsorption. A simple estimation using the experimentally obtained results and calculations of the cohesive energies for an Ar–Ne mixed system qualitatively reproduced the kinetic energy shifts.

Keywords: Desorption induced by electronic transitions (DIET); Noble gases; Photon stimulated desorption

1. Introduction

Photon-stimulated desorption (PSD) in rare gas solids has been extensively investigated over the past 20 years. Various desorption mechanisms in pure rare gas solids have been proposed [1]. One of the commonly accepted mechanisms that leads to desorption of excited atoms is cavity ejection (CE) [1–3]. According to this mechanism, an excited atom created in the rare gas surface layer repels the surrounding ground state atoms owing to the expansion of the electron configurations, and consequently the excited atom can desorb into the vacuum.

Several studies have focused on desorption from an adsorbed system on rare gas solids [5–8]. These studies have reported that the altered solid surfaces have a considerable influence on the desorption process; for example, the desorption of metastable atoms via the creation of excited hetero dimers has been observed. To obtain a more detailed insight into desorption from a two–component system, we observed PSD of metastable atoms from Ar adsorbed on a Ne solid.

Here, we report the Ar coverage dependence of the desorption yield and the kinetic energy of the desorbed Ne metastable atoms (Ne^*) via the CE mechanism. The results show that Ne^* can be desorbed even for Ar coverage of a 200 monolayer (ML) even though the yield decreases with the increasing adsorption of Ar atoms. The results indicate that the mixed Ar–Ne layers are formed by adsorbing Ar atoms, instead of a cover layer of Ar on the Ne solid. In addition, we found that the kinetic energy of the desorbed Ne^* depends sensitively on the amount of adsorbed Ar atoms. The kinetic energy shifts caused by the Ar adsorption are thought to be closely related to the change in the cohesive energy and the excitation energy in the mixed layers. We have estimated the mean kinetic energy shift using the experimentally obtained excitation energies