Optical Response of Alkali-Metal-deposited 1*T*-TiS_2 surfaces

T. Wakita[1], Y. Saitoh[2], K. Kobayashi[3], S. Negishi[4], M. Arita[4], H. Namatame[4], M. Koyano[5], M. Hirai[1], Y. Muraoka[1] and T. Yokoya[1],

[1]*Research Laboratory for Surface Science, Faculty of Science, Okayama University, 3-1-1 Tsushima-naka, Okayama, 700-8530, Japan,*
[2]*Spring-8/JAEA, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan,*
[3]*Spring-8/JASRI, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan,*
[4]*Hiroshima Synchrotron Radiation Center, Hiroshima University, 2-313 Kagamiyama, Higashi-Hiroshima, 739-0046, Japan,*
[5]*School of Materials Science, JAIST, 1-1 Asahidai, Nomi, Ishikawa 923-1292, Japan*

Charge density waves (CDW's) appear to occur in a number of two-dimensional layered transition-metal dichalcogenides, such as 1*T*-TaS_2 and 1*T*-$TaSe_2$ [1]. In the case of 1*T*-TiS_2, appearance of impurity-induced localized CDW's in atomic scale was reported based on STM observation [1], although no global CDW formation is known to exist at any temperature. Under alkali metal (AM) deposition on a TiS_2 surface, AM atoms act as impurities, and might form larger AM-induced CDW domains on that surface [2]. Since such AM-induced CDW's will change the band gap of a TiS_2 surface known as a 'dirty' semiconductor, it is important to study the optical response with ultra-violet (UV) light having energy near the band gap. In this study, we have investigated domain formation of AM-deposited TiS_2 surfaces and their optical responses for UV light employing photoelectron emission microscopy (PEEM) and angle resolved photoemission spectroscopy (ARPES). The experiments have been performed using PEEMSPECTOR (Elmitec) at SPring-8 as well as on the beamline-5 at HiSOR where PEEM (PEEMIII, Elmitec) and ARPES (HA50, VSW) stations are installed in tandem and the sample is transferred between two stations *in situ*. Figure 1 shows the PEEM images of a Rb-deposited 1*T*-TiS_2 surface, (a) after 2 seconds and (b) after 60 seconds under a Hg lamp illumination. We can see clear contrast patterns upon Rb deposition in Fig. 1(a). After 60 seconds, the contrast changed drastically as shown in Fig. 1(b). The initial contrast appears again after a few minutes on turning off the Hg lamp. The origin of this phenomenon will be discussed from the PEEM measurements with synchrotron radiation combining with ARPES measurements for the same sample.

[1] G. P. E. M. Van Bakel and J. Th. M. De Hosson, Phys. Rev. B **46**, 2001 (1992).
[2] S. E. Stoltz *et al.*, Phys. Rev. B **67**, 125107 (2003).

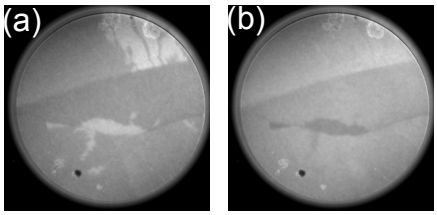

Fig.1. PEEM images of Rb-deposited 1*T*-TiS_2 surfaces. The field of view is 100 micron.