RIKEN Seminar

Date: Friday, 27th June 2014, 14:00-15:00

Venue: 2F Seminar room, Nanoscience building (Emergent Matter Science Research Laboratory)

Synthesis and structure of MoSx

LUDWIG BARTELS

Professor of Chemistry at the University of California, Riverside

Transition metal dichalcogenides (TMDs) such as MoS_2 have attracted widespread attention because they combine some of the fascinating properties of graphene, such as stability at the monolayer limit and well-defined transport properties, with native semiconducting and direct-bandgap behavior. MoS_2 has proven to be almost as stabile as graphene and it can be prepared at significantly lower temperatures which are compatible with patterned Si/SiO_2 substrates. In the first part of my talk, I will describe methods of CVD fabrication of single layer TMDs and their alloys using organic chalcogen precursors.[1] I will also describe the ensuing properties of the alloy materials. In the second part of my talk, I will address the growth of molybdenum-sulfur compounds on a Cu(111) surface as investigated by scanning tunneling microscopy. In particular, we find a range of non-MoS_2 surface structures and characterize their interaction with oxygen-containing adsorbates such as anthraquinone and formic acid. The highest binding affinity is found for a surface structure that is identified as Mo_2S_3, and not for the edges of MoS_2 islands, to which typically activity of MoS_2-based catalysts is attributed.[2]

1. Mann, J., Ma, Q., Odenthal, P.M., Isarraraz, M., Le, D., Preciado, E., Barroso, D., Yamaguchi, K., Son, G.v., Nguyen, A., Tran, T., Wurch, M., Nguyen, A., Klee, V., Bobek, S., Sun, D., Heinz, T.F., Rahman, T.S., Kawakami, R. & Bartels, L. *2-Dimensional Transition Metal Dichalcogenides with Tunable Direct Band Gaps: $MoS_{2(1-x)}Se_{2x}$ Monolayers*, Advanced Materials 26, 1399 (2014)
2. Sun, D., Lu, W., Le, D., Ma, Q., Aminpour, M., Alcántara Ortigoza, M., Bobek, S., Mann, J., Wyrick, J., Rahman, T.S. & Bartels, L. *An MoSx Structure with High Affinity for Adsorbate Interaction*, Angewandte Chemie **124**, 10430-10434 (2012).