BASIC INFORMATION ON SUB-PROJECT

NAME OF PROGRAMME/FUND	Scholarship Fund - Sciex NMS^{ch}
RESEARCH FIELD AND OTHER RESEARCH FIELDS INVOLVED (if applicable)	Physics, Chemistry
TITLE OF THE SUB-PROJECT	Corrosion resistant self-assembled monolayers of functionalized dicarba-closododecaborane clusters on Au, Ag and Cu surfacess (CoSAMDoc)
REGION OF THE CZECH REPUBLIC (according to the location of the home institution)	Prague
GRANT AMOUNT SPENT	94 585,90 CHF
INTERMEDIATE BODY	Swissuniversities
HOME INSTITUTION	Academy of Sciences of the Czech Republic Institute of Physics
HOST INSTITUTION	EMPA, Swiss Federal Laboratories for Materials Science and Technology Advanced Materials and Surfaces
NAME OF THE FELLOW	Aliaksei Vetushka

ABSTRACT OF THE SUB-PROJECT	Dicarba-closo-dodecaboranes, inorganic cluster species with icosahedral molecular architecture, represent a new family of molecules for self-assembled monolayers (SAMs). These species exhibit high stability against chemical and thermal degradation, and are potential stable components of various molecular devices. Within this context, the structure and corrosion protection properties of SAMs composed of different functionalized dicarba-closo-dodecaborane derivatives will be investigated during the planned SCIEX Fellowship. Particular attention will be paid to the corrosion protection of silver substrates (functional textiles, electronic applications), but copper and gold surfaces will also be considered for comparison purpose. Boron-rich supramolecular assemblies with precisely controlled dimensions and chemical composition will be prepared using a layer-by-layer fabrication technique. Characterization of these novel surface-immobilized nanostructured materials, based on dicarba-closo-dodecaborane clusters with relatively strong molecular dipoles, requires the use of a Scanning Kelvin Probe Force Microscope (SKPFM) as a fundamental analytical tool. In the Environmental AFM instrument available at the EMPA, surface charges and dipoles can be measured under simultaneous precise environmental control from high vacuum to high relative humidity. This allow characterizing chemisorption processes and obtaining input data for DFT calculation of SAMs on periodic structures. In a second stage of the project, cycling of environmental parameters such as temperature and humidity will be performed to develop an experimental methodology of environmental stress factors used to assess the surface stability of the SAMs. The ultimate goal is to obtain laterally homogeneous SAMs resistant to very aggressive H2S environment. For this purpose, local electrochemical characterization by means of the Scanning Electrochemical Nanocapillary (measured areas smaller than 50nm) will be used to assess the lateral homogeneity of the deposited protecting SAMs. Finally, exposure to model industrial climate containing H2S will be envisaged to simulate the most aggressive case relevant to Silver corrosion.

MAIN RESULTS	1) The main results are summarized in the A. Vetushka, L. Bernard, O. Guseva, Z. Bastl, J. Plocek, I. Tomandl, A. Fejfar, T. Baše, and P. Schmutz, physica status solidi (b) (2015), DOI: 10.1002/pssb.201552446. 2) Because of the established collaboration between Empa and Institute of Physics AS CR the joint paper was published in 2014: K. Schöller, S. Küpfer, L. Baumann, P. M. Hoyer, D. de Courten, R. M. Rossi, A. Vetushka, M. Wolf, N. Bruns, and L. J. Scherer, Adv. Funct. Mater. 24, 5194 (2014).
DATE OF REALISATION OF THE FELLOWSHIP	1.11.2012 - 31.10.2013
MORE INFORMATION ON THE PROGRAMME	**www.sciex.ch**