BASIC INFORMATION ON SUB-PROJECT

NAME OF PROGRAMME/FUND	Scholarship Fund - Sciex NMS^{ch}
RESEARCH FIELD AND OTHER RESEARCH FIELDS INVOLVED (if applicable)	Physics, Engineering Sciences
TITLE OF THE SUB-PROJECT	HeteroInterface Tests Stability (HITS)
REGION OF THE CZECH REPUBLIC (according to the location of the home institution)	Prague
GRANT AMOUNT SPENT	96 352,35 CHF
INTERMEDIATE BODY	Swissuniversities
HOME INSTITUTION	Institute of Physics of the ASCR v. v. i., Optical materials
HOST INSTITUTION	Ecole Polytechnique Fédérale de Lausanne, Photovoltaics and thin film electronics laboratory
NAME OF THE FELLOW	Jakub Holovský

ABSTRACT OF THE SUB-PROJECT	In this project, we exploited the properties of crystalline silicon wafers as a sensitive probe to study the properties of amorphous silicon (a-Si:H) films. These films were deposited on the wafer surfaces and find application in high-efficiency heterojunction solar cells. We extended standard optical (FTIR) and electronic (Sinton) characterization techniques to probe the defects and microstructure of a-Si:H by using high-grade crystalline silicon substrates. By detection of electronic properties of bulk crystalline silicon we could efficiently study its surface states or its interface with passivation layer of a-Si:H. These surfaces or interfaces were studied independently also by infrared spectroscopy in attenuated total reflectance mode, called ATR-FTIR. This technique was also applied to the study of the stability of amorphous silicon under light soaking. As a main outcome of the project we confirmed the role of mobile hydrogen in the (meta-) stability of amorphous silicon.

MAIN RESULTS	The main scientific result is a new model of light induced degradation/annealing process on a-Si:H/c-Si interface claiming that the hydrogen motion is strongly linked to irreversible processes in the amorphous silicon[1]. Secondly, as a vast amount of interesting experimental ATR-FTIR data was gathered, a part of it was used in second publication intended as a reference methodological paper of this method applied in the silicon heterojunction technology[2]. The problem of ultrathin passivation layers has brought us to the phenomena of thin-film limit of the ultrathin layers. We developed this topic further into another publication showing its interesting consequences for measureable properties of graphene[3] and for surface defect density measurements[4]. [1] El Mhamdi, E. M.; Holovsky, J.; Demaurex, B.; Ballif, C.; De Wolf, S. *Is Light-Induced Degradation of a-Si:H/c-Si Interfaces Reversible?* Appl. Phys. Lett. 104, (2014) 252108. [2] Holovský, J.; De Wolf, S.; Jiříček, P.; Ballif, C. *Attenuated Total Reflectance Fourier-Transform Infrared Spectroscopic Investigation of Silicon Heterojunction Solar Cells*. Rev. Sci. Instrum., 86, (2015) 073108. [3] Holovský, J.; Nicolay, S.; De Wolf, S.; Ballif, C. *Effect of the Thin-Film Limit on the Measurable Optical Properties of Graphene*. Sci. Rep. 5 (2015) 15684. [4] Holovský, J.; Ballif, C. *Thin-Film Limit Formalism Applied to Surface Defect Absorption*, Opt. Express 22, (2014) 31466.
DATE OF REALISATION OF THE FELLOWSHIP	1.10.2012 - 30.9.2013
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