2012A 期 採択長期利用課題の事後評価について

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2012A 期に採択された長期利用課題について、2014B 期に3年間の実施期間が終了したことを受け、第54回 SPring-8利用研究課題審査委員会長期利用分科会（平成27年10月）による事後評価が行われました。

事後評価は、長期利用分科会が実験責任者に対しヒアリングを行った後、評価を行うという形式で実施し、SPring-8利用研究課題審査委員会で評価結果を取りまとめました。以下に評価を受けた課題の評価結果を示します。研究内容については本誌5ページの「最近の研究から」に実験責任者による紹介記事を掲載しています。

課題名	Development of Spin-HAXPES technique for the Exploration of the Electronic structure of Buried layers and Interfaces
実験責任者(所属)	Claudia Felser (Max Planck Institute of chemical physics of solids)
採択時課題番号	2012A0043
ビームライン	BL47XU（2012A～2014A 利用)、BL09XU（2014B のみ利用）
利用期間 / 配分総シフト	2012A～2014B/180シフト (BL47XU: 150シフト、BL09XU:30シフト)

［評価結果］

This proposal aimed to realize spin-resolved hard-x-ray photoemission spectroscopy (Spin-HAXPES) by introducing the multi-detection spin filter system into the HAXPES system at SPring-8. The Spin-HAXPES especially in the valence band region is essential, as the bulk-sensitive and spin-resolved technique, to investigate electronic and magnetic structures of buried layers and their interfaces. Spin-HAXPES is also expected to be one of the best techniques to obtain the evidence of half-metallic nature of materials such as Heusler alloys. Being expected significant impacts on scientific and technical fields, this proposal was accepted by the committee even though many technical difficulties were anticipated. Owing to the serious delay, however, the multi-detection system originally proposed has not been constructed, and the conventional SPLEED has been introduced, instead. With much effort to overcome many experimental difficulties such as discharge problems, and by moving the system to the higher photon density beamline (BL09XU), spin-resolved HAXPES of Fe 2p core-level was successfully obtained, though with poorer statistics than MCD. Then finally the spin-resolved valence band structure of buried interfaces of $Co_2Mn_{1.24}Fe_{0.16}Si_{0.84}$ has been measured for the first time. However, low signal to noise ratio of the obtained spectrum does not seem to allow quantitative and reliable comparison with the existent theoretical calculation. Other than spin-resolved measurements, spin-integrated measurements on buried magnetic layers and spintronics materials have been carried out successfully. A number of results on magnetic layers and spintronics materials have been published in 11 peer-reviewed journals including a major journal. However, there was no publications on the spin-resolved detection that had been strongly hoped for by the committee when this proposal was accepted. Overall, the committee judged the overall achievements of the proposal “Successful but Unsatisfactory”. This evaluation would be not only for the past but also for the future because the ex-post report represents no concrete plan for the multi-channel spin detector that would be requisite for realization of “Spin-HAXPES” in the valence band.

［成果リスト］

(査読あり論文)

［1］ SPring-8 publication ID = 23225
S. Ouardi *et al*.: “Stoichiometry Dependent Phase Transition in Mn-Co-Ga-based Thin Films: From Cubic in-plane, Soft Magnetized to Tetragonal

Perpendicular, Hard Magnetized" *Applied Physics Letters* **101** (2012) 242406.

[2] SPring-8 publication ID = 24784
R. Shan *et al*.: "Electronic and Crystalline Structures of *Zero Band-Gap* LuPdBi Thin Films Grown Epitaxially on MgO(100)" *Applied Physics Letters* **102** (2013) 172401.

[3] SPring-8 publication ID = 25119
C. Viol Barbosa *et al*.: "Magnetic Dichroism in Angular Resolved Hard X-ray Photoelectron Spectroscopy from Buried Magnetic Layers" *Journal of Electron Spectroscopy and Related Phenomena* **189** (2013) 146-151.

[4] SPring-8 publication ID = 25350
C. Viol Barbosa *et al*.: "Direct Observation of Band Bending in the Topological Insulator Bi_2Se_3" *Physical Review B* **88** (2013) 195128.

[5] SPring-8 publication ID = 25351
S. Ouardi *et al*.: "Bulk Electronic Structure Studied by Hard X-ray Photoelectron Spectroscopy of the Valence Band: The Case of Intermetallic Compounds" *Journal of Electron Spectroscopy and Related Phenomena* **190** (2013) 249-267.

[6] SPring-8 publication ID = 27186
J. Karel *et al*.: "Distinct Electronic Structure of the Electrolyte Gate-Induced Conducting Phase in Vanadium Dioxide Revealed by High-Energy Photoelectron Spectroscopy" *ACS Nano* **8** (2014) 5784-5789.

[7] SPring-8 publication ID = 27187
C. Viol Barbosa *et al*.: "Investigation of the $Mn_{3-\delta}Ga$/MgO Interface for Magnetic Tunneling Junctions" *Journal of Applied Physics* **116** (2014) 034508.

[8] SPring-8 publication ID = 28275
C. Viol Barbosa *et al*.: "Forward Scattering in Hard X-ray Photoelectron Spectroscopy: Structural Investigation of Buried Mn–Ga Films" *Applied Physics Letters* **106** (2015) 052402.

[9] SPring-8 publication ID = 28717
S. Ouardi *et al*.: "Magnetic Dichroism Study on $Mn_{1.8}Co_{1.2}Ga$ Thin Film using a Combination of X-ray Absorption and Photoemission Spectroscopy" *Journal of Physics D: Applied Physics* **48** (2015) 164007.

[10] SPring-8 publication ID = 28718
O. Meshcheriakova *et al*.: "Structural, Electronic, and Magnetic Properties of Perpendicularly Magnetised Mn_2RhSn Thin Films" *Journal of Physics D: Applied Physics* **48** (2015) 164008.