

Spin Hall effect in AuW alloys

Piotr Laczkowski, Juan Carlos Rojas-Sánchez, Yu Fu, Williams Savero-Torres, Nicolas Reyren, Cyrile Deranlot, Jean-Marie George, Henri Jaffrès, Lucien Notin, Cyrile Beigné, et al.

▶ **To cite this version:**

Piotr Laczkowski, Juan Carlos Rojas-Sánchez, Yu Fu, Williams Savero-Torres, Nicolas Reyren, et al.. Spin Hall effect in AuW alloys. SPIE 9931, Spintronics IX, Aug 2016, San Diego, United States. pp. 993108, 10.1117/12.2238694 . cea-01511834

HAL Id: cea-01511834
https://cea.hal.science/cea-01511834

Submitted on 21 Apr 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

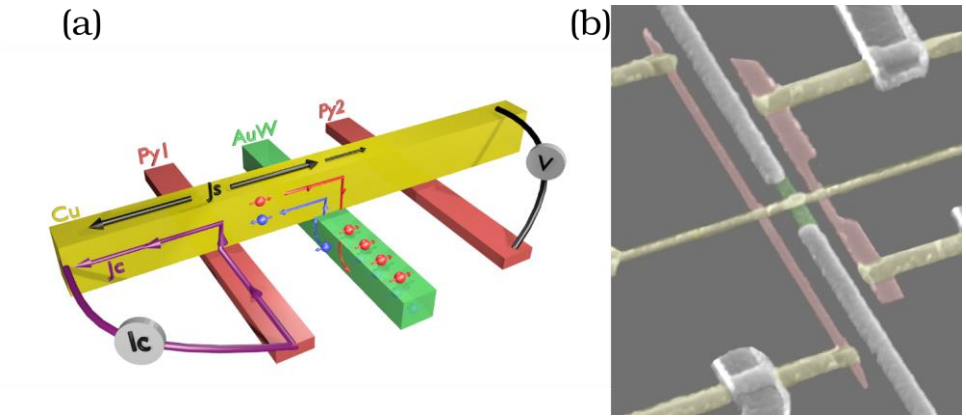
Spin Hall effect in AuW alloys

Piotr Laczkowski[1,2] *, Juan Carlos Rojas-Sánchez[1,2], Yu Fu[2], Williams Savero-Torres[2], Nicolas Reyren[1], Cyrile Deranlot[1], Jean-Marie George[1], Henri Jaffrès[1], Lucien Notin[2], Cyrile Beigné[2], Alain Marty[2], Patrick Warin[2], Jean-Philippe Attané[2], Laurent Vila[2] and Albert Fert[1]
[1]UMR/CNRS-Thales and Université Paris-Sud, 91767, Palaiseau, France
[2]Institut Nanosciences et Cryogénie, CEA and Université Grenoble Alpes, 38054 Grenoble, France

* piotr.laczkowski@gmail.com

The spin Hall effect (SHE) [1] allows for a reciprocal conversion between charge and spin currents using the spin orbit coupling which can be at the core of several promising spintronics devices. The spin orbit interaction is used to produce a transverse flow of spin or charge in response to a longitudinal excitation, these are the direct or inverse SHE. The spin Hall angle (SHA), the ratio of longitudinal and transverse electronic conductivities, is the characterizing parameter of this conversion. So far, large SHA have been reported in transition metals like Pt, Pd, W, Beta-Ta and in a few alloys with large spin orbit coupling impurities: CuIr, CuBi or CuPb [2].

In this presentation we will report on our study of the SHA in AuW alloys [3] which exhibits a non-monotonic relation with the W concentration. In the regime of diluted alloys the behaviour suggests a dominant side-jump contribution to the spin Hall resistivity, the SHA increasing with the W concentration. We will present experiments demonstrating the requirement of new spin-absorption model in lateral spin valves adapted to the case of strong spin absorption for a correct evaluation of the SHA. Altogether with complementary Ferromagnetic Resonance Spin-Pumping studies, it then leads to SHA as large as +15%. At higher W content the SHA sign is reversed, becoming negative as for pure W.



[1] J.E. Hirsch, *PRL* **83,** 1834 (1999).

[2] Y. Niimi *et al.*, *PRL* **106,** 126601 (2011), *PRL* **109,** 156602 (2012), *PRB* **89,** 054401 (2014).

[3] P. Laczkowski *et al.*, *APL* **104**, 142403 (2014). P L. et al arxiv