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Inverse spin Hall effect in Cr metal DANRU QU, Johns Hopkins University, SSU-YEN HUANG, National Taiwan University, CHIA-LING CHIEN, Johns Hopkins University — Spin Hall angle, which measures the conversion efficiency between spin current and charge current, is the most important quantity in spin current phenomena. Sizable spin Halls angle have thus far been reported exclusively in non-magnetic materials of heavy elements, such as Pt and Au [1], and recently in ferromagnetic metals, such as Py [2]. In this work, we use the thermal spin injection method to inject a spin current from ferromagnetic insulator YIG into a 3d metal Cr, which is a well-known antiferromagnet (AF) with spin density ordering. We report the observation of inverse spin Hall effect (ISHE) in Cr with a large spin Hall angle, comparable to that of Ta. Through measurements above and below the Néel temperature of the AF ordering, we show that the origin of the large ISHE in Cr is not due to its spin density wave AF ordering. Moreover, there is no magnetic proximity effect that plagued Pt and Ta. These features show that Cr can be a superior spin current generator/detector in pure spin current phenomena and devices.

[1] D. Qu, S. Y. Huang, B. F. Miao, S. X. Huang, and C. L. Chien, *Phys. Rev. B* **89**, 140407(R) (2014).

[2] B. F. Miao, S. Y. Huang, D. Qu and C. L. Chien, *Phys. Rev. Lett.* **111**, 066602 (2013)

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