

Adatoms and dimers on Mn/W(110): Intra-atomic noncollinear magnetism and TAMR

Noncollinear spin structures at surfaces and interfaces draw great attention due to potential applications in spintronic devices. In such magnetic structures, spin direction varies from atom to atom. Besides this interatomic noncollinear magnetism, there is also intra-atomic noncollinear magnetism (IANM) where the spin direction varies for different orbitals of an atom [1]. It can occur due to spin-orbit coupling (SOC) or due to a noncollinear spin structure. Here, we show IANM can occur for adatoms on a magnetic surface with a noncollinear spin structure [2]. We study Co and Ir adatoms on Mn/W(110) using DFT. We find canted spin structure of the Mn surface layer is encoded into different orbitals of the adatoms. Our conclusions apply in general to adatoms on surfaces with a noncollinear magnetic structure e.g. spin spirals, skyrmions or domain walls & explain recent experimental results of SP-STM experiments [3]. We have also explored TAMR of $6p$ dimers adsorbed on Mn/W(110) [4]. These dimers are likely to show large TAMR due to strong SOC. Mn/W(110) surface acts as an excellent choice to explore the angular dependence of TAMR of adsorbed dimers using STM. We predicted 60% TAMR compared to 20% TAMR observed for Pb dimers adsorbed on Fe/Fe/W(110) [5].

[1] L. Nordström et al., PRL. 76, 4420 (1996)

[2] S. Haldar et al, PRB 98, 220401 (R) (2018)

[3] D. Serrate et al., PRB 93, 125424 (2016)

[4] S. Haldar et al., Manuscript.

[5] J. Schöneberg et al., PRB 97, 041114(R) (2018)

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