Tuning Spin Transport Across Two-Dimensional Organometallic Junctions

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We study via first-principles modeling and simulation two dimensional spintronic junctions made of metal-organic frameworks consisting of two Mn-phthalocyanine ferromagnetic metal leads and semiconducting Ni-phthalocyanine channels of various lengths. These systems exhibit a large tunneling magnetoresistance ratio; the transmission functions of such junctions can be tuned using gate voltage by three orders of magnitude. We find that the origin of this drastic change lies in the orbital alignment and hybridization between the leads and the center electronic states. With physical insight into the observed on-off phenomenon, we predict a gate-controlled spin current switch based on two dimensional crystallines and offer general guidelines for designing spin junctions using 2D materials.

This work was supported by the US Department of Energy (DOE), Office of Basic Energy Sciences (BES), under Contract No. DE-FG02-02ER45995. Computations were done using the utilities of NERSC and UFRC.