Modelling of spin-dependent mechanical friction at atomic level

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Though magnetic coupling is considered to be noticeably weaker than chemical, electronic interactions, it has been recently shown by Wolter and co-workers [1] that spin-spin exchange energy can considerably influence the friction between magnetic materials. In our work a simple 2D model of pseudostatic friction at atomic level has been prepared, in the frame of which both Lennard-Jones potential and spin-dependent term of exchange interaction has been included. It has been demonstrated, that for iron both average lateral and normal forces between atoms of "base" and "slider" in the tribological node are altered through the change of relative direction of spins, by over a dozen of percent, when the interatomic distance is comparable to the lattice constant. Spin-dependent correction of friction coefficient has been estimated.

References:

[1] B. Wolter, Y. Yoshida, A. Kubetzka, S.-W. Hla, K. von Bergmann, R. Wiesendanger, "Spin friction observed on the atomic scale", Physical Review Letters **109** (2012) 116102-1 - 116102-5.